

The Iron Age

A Review of the Hardware and Metal Trades.

Published every Thursday Morning by DAVID WILLIAMS, No. 10 Warren Street, New York.

Vol. XV: No. 10.

New York, Thursday, March 11, 1875.

\$4.50 a Year, Including Postage.
Single Copies, Ten Cents.

The Late E. B. Ward, of Detroit.

The portrait of the late Capt. E. B. Ward, which we this week present to our readers, will be recognized as one which presents the likeness and preserves the expression with a fidelity rarely attained in wood engraving. The delay in securing a satisfactory photograph, and the care with which we caused the engraving to be executed, have prevented our sooner giving it to the public.

Captain Ward was a man so well known to the American iron trade that no obituary notices are needed to commemorate his great enterprise or his great successes. Like most Western capitalists, he was pre-eminently a self-made man. In early life he abandoned farming, to which he was reared, and learned the printer's trade. Tiring of an occupation unsuited to his temperament, and affording so little opportunity for the exercise of his faculties, he became a sailor on the lakes, and subsequently acquired a knowledge of business as a clerk in a warehouse at Marine City (then called Newport), on the St. Clair River, about fifty miles from Detroit. From this position he advanced to the ownership and management of a line of steamboats. He thus laid the foundation of the fortune which he invested and greatly increased in iron manufacture.

Early in the opening of Western railroad routes he saw that iron mills would be needed, and about 1850 bought a large share of the Eureka Iron Company, a Detroit furnace enterprise, located ten miles below the city, where the thriving iron making town of Wyandotte now stands. Under his management the Eureka began to prosper. The Wyandotte Rolling Mill was built near it, and he thus became the pioneer in iron making beyond Ohio, his friends gravely fearing ruin to his interests from this venture. But the sagacious foresight, which was one of his remarkable qualities, proved wise in this as in most of his enterprises. The Wyandotte mills and furnaces now employ some 500 men, the making of boiler plates, chains and bars of Lake Superior iron, and of best quality, being a specialty, and the rail mill turning out some 15,000 tons a year. A few years later the North Chicago rolling mills and furnaces were started, and within the past four years five mills have been enlarged and improved, a Bessemer steel mill added, furnaces capable of smelting fifty tons of pigs a day built, and some 1600 men are employed there, with contracts for a full year to come. The Milwaukee Iron Company was next organized, furnaces like those at Chicago built, and a fine rail mill put in operation, where over 1000 men are employed, and work is engaged for months in advance. Capt. Ward owned a charcoal furnace at Leland, on the lake shore, in the forests of Northwestern Michigan, and the New England iron mine back of Marquette, on Lake Superior. The Chicago and Milwaukee companies, in which he was an active and leading owner and officer, also held a tract of over 1000 acres of red fossiliferous ore in Wisconsin, west of Milwaukee, on the railroad, using the hard ore for making rails with softer Lake Superior iron—one for the top and the other for the web and flange. He also owned iron banks in the Menominee district in Wisconsin, coal beds in Pennsylvania, and vessels for shipment of ore, coal and lumber, his steamboat interest being limited as he grew into the iron business. He owned \$1,500,000 of stock in Chicago, with \$500,000 in Milwaukee, \$400,000 in Wyandotte and \$100,000 at Leland, counting all at par. These great enterprises will all miss the good judgment and clear foresight of Capt. Ward, but he has left them in good hands which will probably carry forward successfully what he so successfully began.

Mr. Ward had some 80,000 acres of valuable pine lands in Michigan, and large saw mills at Ludington, on the western terminus on the lake of the Flint and Pere Marquette Railway. Of that road he was president, and left it in best condition. He also had a large tract of timber land on the Maumee River, below Toledo, and had lately helped largely to organize and start the Crystal City Plate Glass Works, just below St. Louis, Mo. Probably no one man has done more to develop the industrial resources of the Northwest, and the place left vacant by his death will not soon be filled.

Personally, Capt. Ward was an affable and agreeable gentleman. Those who knew him liked or loved him according to the intimacy of their acquaintance with him. His liberality was large, his benevolence comprehensive, his charity unostentatious. He was a generous and untiring champion of the best interests of the laboring classes, and none have mourned him more truly than those who, in humble stations in life, were the beneficiaries of his favor or the recipients of his bounty.

The appearance of silver may be imparted to iron wire by a thin film of tin. The wire is first placed in hydrochloric acid, in which is suspended a piece of zinc. It is afterward placed in contact with a strip of zinc in a bath of two parts tartaric acid dissolved in 100 parts of

water, to which is added three parts of soda. The wire should remain about two hours in this bath and then be removed, and made bright for polishing or drawing through a polishing iron. By this galvanic method of tinning, wire which has been wound in a spiral, or iron of other shape, can be made quite white, which is an advantage over most other methods, where the wire is tinned in the fire and then drawn through a drawing plate. —(Dr. Heeren's process.)

An English Iron Master on the Iron and Steel Industries of the United States.

We take the following from the London Mining Journal: Whilst the ironmasters of Great Britain are awaiting a complete report from Mr. I. L. Bell of his visit to the iron and steel works of America, the views of a Staffordshire ironmaster upon what he saw during

rolls in this country. That principle obviated the use of grooved rolls in the rolling of bars, and saved the great delay and cost entailed by the frequent changing of rolls. The purpose was attained by the use of small vertical as well as the usual horizontal rolls. Thus by the shifting of the vertical rolls so as to bring them closer together, or remove them further apart, bars of any required width, up in this case to 16 in., might be rolled with the same horizontal rolls. There were steam hammers in the same works, and slotting machines, together with rivet making and other similar machines for completing small work. The proprietors went in for as great a variety of products with as small but as complete a plant as possible. Nor did they neglect their operatives. By the use of water, which constantly trickled upon plates of iron suspended in front of the furnace doors, the inside of the works became in hot weather cooler than the outside. Further, by the use

was pointed out that at Ironton, 10 miles from Niagara, two blast furnaces were in course of erection. The engine house of these furnaces, which could not be matched for style and spaciousness in England, Mr. Molineux described as having the appearance of a mansion fit for the abode of a man with an income of from £1500 to £2000 a year. Four furnaces were ultimately to be put up here, the proprietors having bought no less than 300 acres of land for the purpose of their works. The engine house he had depicted was the home of two condensing engines, having 54 in. steam cylinders, 96 in. wind cylinders, and a 7 ft. stroke. Twenty boilers, 55 ft. long and 3 ft. diameter, supplied the engines with steam; and there were eight or ten hot air ovens to each furnace, so arranged that any one could at any time be cut off for repairs without interfering with the working of the furnaces. Lake Superior ore for these furnaces was being unloaded on the ground from

two 8 in. wire mills. The most recently erected of these had been fitted up at great expense, the chocks being made of Bessemer steel (planned to fit); instead of liners for chocks, wedges were used, planned, fitted and screwed in in the nicest manner. Here, too, was a set of three-high 16 in. rolls for billeting down all their steel rail ends to a 2 in. by ½ in. bar. In this shape the steel was charged into the mill furnace by a door at the back, and after being drawn out at the other side, was rolled into wire. Every pound of their Bessemer scrap they seemed to be using up in one way or another. The works had not been short of orders all the time Mr. Howell had been manager; and when, in the autumn of 1873, Mr. Molineux was at the works, Mr. Howell said that they had orders on their books which would take them two years to execute.

At Chicago there were the North Branch Bessemer Works, having two blast furnaces; two forges, with three high forge rolls; two rotary squeezers; two three-high rail mills—one for iron and one steel; and everything as complete and efficient as possible, alike as to minimizing labor and permitting no waste.

At St. Louis there was an iron works which had been laid down by an Englishman, which was as good nearly as it was 25 years ago, and this same Englishman, who went out from Cleveland—and in doing so, never, in Mr. Molineux's opinion, made a greater mistake in his life—had designed no inconsiderable portion of the iron works machinery of the States.

Upon calling at Ohio Falls Iron Works, at New Albany, near Louisville, when his name was announced, the manager, who was an Englishman named Dangerfield, told him that he was at that moment reading an account in an American paper of a new furnace that he (Mr. Molineux) had just put up at his works at Moxley. Now, that news from the date at which the fact was published in this country had traveled faster than he had himself, and he mentioned the fact to show how watchful an eye the American iron and steel masters were keeping upon what was being done in those industries in the old country.

Works at Cincinnati, at Youngstown, at Johnstown and elsewhere were described, and much significance attached to the Cambria Works, at Johnstown, with its four blast furnaces, its forty-six double puddling furnaces, and its admirable and extensive steel making and steel working appliances. Space will not, however, allow us to do more now than to add that, while Mr. Molineux is profoundly impressed with the vast strides in iron and steel making and manipulating which the Americans have made in the past twenty five years, still he does not despair of an excellent business being possible with them for a long time to come. They have, he says, much overdone the work of preparing to meet the American demand, and they have done this at a very heavy first cost. With moderate prices in England the British iron master, Mr. Molineux believes, may safely calculate on keeping the United States as one of his customers. The two greater difficulties with which the iron and steel producer of America has to contend are dear labor, and, to some of the native markets, expensive land carriage. Illustrative of the cost of labor in the States, he pointed out that at the time the puddlers in this country were being paid the very high and unexampled figure of 12 ½ per ton, puddlers in America were being paid nearly twice that sum; and he showed that a roller who had three hoop mills in his care was from that source netting £1000 a year, and was, moreover, the owner of a much used livery stable. Relative to the expense of carriage to some of the American markets, Mr. Molineux does not think that it costs much, if any more, to carry iron from some of the British iron works across the Atlantic to New York than it does to take iron from Pittsburgh to that market.

A prohibitive tariff is what, in his opinion, English iron and steel masters have most to fear, but he does not believe in the probability of such a duty. He speaks most highly of the frankness with which American iron and steel makers everywhere, with one solitary exception, threw open to him the whole of their works. "We have, they said, no secrets, and we will give you any explanation you need." The exception was that of some steel works which certain manufacturers from Sheffield had started near to Philadelphia. But even to those works he might, perhaps, have obtained admission if the proprietors had not been away. Specimens of the sheets, hoops and horse nails and the like, which he picked up at random in passing through the works, Mr. Molineux showed to the Association, and they were pronounced of much excellence. As he deserved to be, the author was very warmly thanked for his excellent paper, which bristled with facts from beginning to end, and was in no respect discursive.

The Spearman Furnace, Pa., is now blowing out on account of the miners' strike. Of the nine furnaces in Sharpville, every one is now out of blast, and bottom has been reached.



E. B. WARD.

a tour of the iron and steel making localities of the United States have just been made known in a communication of much merit made to the South Staffordshire Mill and Forge Managers' Association, Wolverhampton. The author of the paper was Mr. W. Molineux, ironmaster, of Moxley, near Wolverhampton, who knew the United States iron trade as it existed a quarter of a century before. The progress that had been made in the interval, as well in the using up as in the making of iron and steel, greatly astonished him; nor was he scarcely less surprised at the handy, compact, and generally efficient class of the machinery employed both in the iron mills and the steel shops. Much of this machinery the British iron and steel master had not yet learnt to use in the way in which, with so much resulting economy, the Americans had learnt to use it. Nor had it yet been attempted by iron and steel makers in England to anything like the extent in which it was practiced in America to make a profit upon the utilizing of the iron and steel which they produced. The excellent forge and mill arrangements, and the manner in which the iron and steel made was turned out completed goods all at one establishment, he saw quickly upon landing, at the Passaic Rolling Mills, of Cooke Brothers, at Paterson, New Jersey, only 15 miles from New York. Here was in operation a three high 16 in. forge train (of rolls), and a 16 in. universal mill at the end of the train. He did not know that in any forge train in England the three high system of rolls were used, though three high rolls were used—but not generally—in mills; and in only two or three instances was that which the Americans term the universal principle applied to

of what the Americans termed "the telegraph," the incandescent iron was conveyed from the furnaces to the hammers, and from the hammers to the rolls, suspended in the air, and there was little or no use, therefore, for that other source of heat in the works—floor plates of iron. Close by Mr. Molineux saw what in England was termed a drawing-out forge, where iron and steel of all kinds and sizes was being drawn out and turned, for cast steel in pots was also made in the place, in eight furnaces, producing three heats per day. Whilst he was in the forge a 10 ton crank was in the lathe, and a fine forging, exceedingly well finished, it was. Connecting rods, piston rods &c., were also being there produced. Likewise at Paterson he visited the three locomotive and engineering works, employing together 3000 hands, making locomotives as good as any he had ever seen, and supplying the machinery required by 20 cotton and silk mills in the same town, as well as producing other first-class machinery.

At Albany there were two new blast furnaces at work, producing 420 tons per week, and two more were being erected. Better furnaces he had not seen even in the North of England. Rolling mills and forges were also to be laid down by the proprietors of the furnaces, who had taken some 15 or 20 acres of land for the purpose. The property was connected with the Hudson River and with the Erie Railway. A spacious three storied building at Albany had been taken by a company for making agricultural machines.

Troy, with its Bessemer plant; Syracuse, with its works for making spring steel; and then Rochester, were passed in review; and it

vessels of 1000 or 1500 tons burden. It was being hoisted by hydraulic machinery to a platform 50 ft. high, and thence dropped to the ground, apparently to accumulate mounds of it, that high for use in the winter. Coal had, however, to be brought overland a distance of 80 miles, at a cost of \$4 per ton. At Buffalo Mr. Molineux went over Pratt & Co.'s Iron Works, where there were two forges, twenty-three puddling furnaces, two pair of rotary squeezers and forge train, and a pair of universal rolls. Here, too, the firm were working up their own iron into numerous light articles, such as washers, and nails of all kinds, including excellent horse nails, which the manager said they had been producing by machinery for eight or ten years, and he expressed surprise that England, according to the newspapers, had only just succeeded in adapting machinery to the making of horse nails. Nuts and burrs were being well got up at these works. They were pressed out in an exact square, and were otherwise completely and well executed. The firm expected a considerable addition to their business by reason of the International Bridge, which had been opened since Mr. Molineux had returned home.

Two hundred miles further off he came to Newburg, near Cleveland, where there was an important Bessemer plant, having four blowers, and they were removing the steam hammers and putting down three-high blooming rolls instead. Here there were mills for rolling iron and steel rails, driven by an engine of 350 horse-power. The manager (Mr. Howell) went out five years ago from Wolverhampton, where, at Messrs. Sparrows', he worked as an assistant roll turner. At these works there were also

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Hammered Work in Sheet Metal.

BY OLIVER BYRNE.

(Continued.)

Fig. 12 represents the first stage of making the half of a copper ball; the metal is first driven with a mallet into a concave bed, generally of wood, in which it is hastily gathered up to a sweep of about the third part of a sphere, as *a a*, Fig. 13; but this puckers up the edge like a piece of fluted silk, or the serpentine margin of many shells, in the manner represented at *fff*, Fig. 14, which is of twice the size of Fig. 13.

The next step is to remove the flutes or puckers by means of blows of the raising hammer, applied externally as indicated by the black lines at *h*, Fig. 14; and in Fig. 15 are represented, on a still more enlarged scale, the relative positions of the hammer, anvil and work. Thus *A* represents the globular face of the anvil, *B* the rounded edge of the raising hammer, which, like the pane of an ordinary hammer, stands at right angles to the handle, and *a* *l* shows the work, *a* being the edge and *l* the point of the flute. The blows of the hammer are made to fall nearly on the center *o* of the

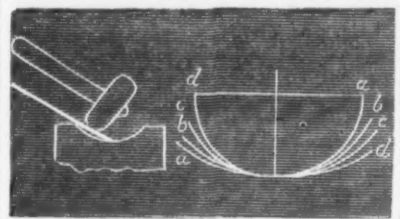


Fig. 12.

Fig. 13.

anvil, and at a small angle with the perpendicular, the hand being on the side *a*. A few blows are given as tangents, or directly across the point of the flute, and when it exceeds the width of the hammer, oblique blows are given to restore the pointed character, to be followed by other blows parallel with the first, as shown at *h*, Fig. 14. These hollow blows cause the sides of the flutes to slide into one another, almost as when two packs of cards, placed like the ridge of a house, penetrate into each other and sink down flat; in a manner somewhat resembling that by which the original and extreme margin in Fig. 11 becomes, by the successive blows, contracted to the inner circle; but in the present case the plate slides down to the general curve of the spherical dish.

If, however, the puckers of a large globe were entirely removed by hollow blows, the central lines of the flutes would become thickened, and therefore solid blows are mingled with them, or rather the one blow partakes of the two natures. Thus, from the curvature and oblique position of the hammer, Fig. 15, its face is solid at *s*, to that part immediately below it, but toward *h* it rather bends than thins; the flatter the curves of the two surfaces, the greater the extent of the solid or thinning blows. The plate is not, however, entirely

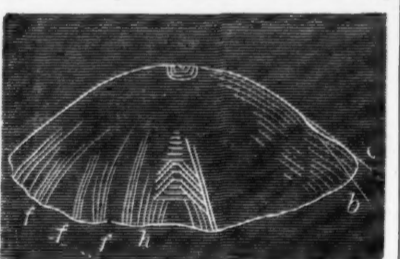


Fig. 14.

gathered up, as the dish *a a*, Fig. 13, always open a little, from the metal becoming stretched under the treatment for removing the flutes.

Throwing the works into flutes, as described, is not imperative, for the hemisphere might be entirely raised, as in the succeeding step, by blows on the outer surface upon a convex tool, or head, but the flutes quicken the process, and speedily give a concavity which is convenient, as it makes the work hang better on the rounded face of the anvil.

The outer curve *a a*, Fig. 13, which represents the copper dish when the puckers have been removed, will not be sent into the hemispherical form, or the inner line *d d*, at one process, but will progressively assume the curvatures *b b*, *c c*, and sometimes many others. Neither will the work be changed from the curve *a a*, to that of *b b* at one sweep, or, as with the burnisher in spinning, even by one consecutive ring, or wave. The hammer must necessarily operate by successive blows arranged in circles, the proximity of which circles will at length include within their range the entire sweep *a a*, or *b b*, each of which is called a course; and before proceeding from one course, or sweep, to the next, the metal requires to be annealed.

Figs 15 and 16 explain the transition, or conversion, from the first sweep *a*, to the second sweep, *b*. The black lines represent the metal after a circle of blows have been given. Fig. 17

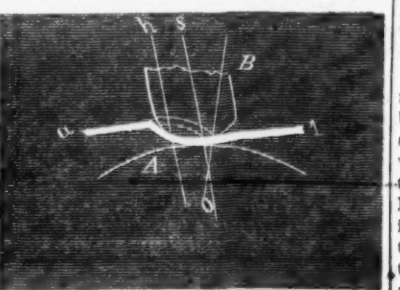


Fig. 15.

shows the narrow edge of the raising hammer in the act of descending upon the center of the head, or stake, and as a tangent to the circle. It first throws in a little rim at *l*, which connects the new and old sweeps by a curve, or ogree; then another little circle, *2*, will be similarly gathered in; then *3*, *4*, *5*, and so on, up to the

edge. Now, the artifice consists in making the intervals, both of the great sweeps *a b c*, Fig. 13, and of the little waves *1, 2, 3*, of Fig. 16, as large as practicable, provided they do not cause the exterior metal to pucker or become in plates, as this would endanger its ultimately cracking at those places where the metal might have become plaited.

In thus raising-in the metal, it necessarily becomes thickened from its contraction in diameter, but as in Fig. 15 the hammer at *h* gives a hollow blow and bends, whilst the part *s* gives a solid blow and thins, the two effects are thus combined; and when they are duly proportioned by a hammer more or less round, and blows more or less oblique, the true thickness, as well as the desired change of figure, are both obtained.

It is easier to get the hemisphere by a little excess of thinning, or by a superfluity of blows;

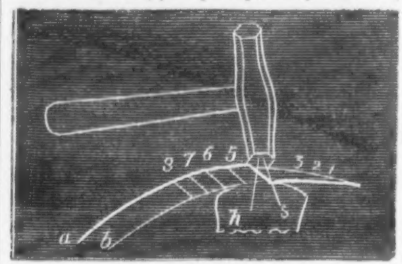


Fig. 16.

so that the less skillful workman will use a piece of copper of 7 inches diameter, with additional blows, for a 6 inch hemisphere; but the more skillful will take a piece of 7½ inches diameter, and obtain the work with less labor. Occasionally, when the work is common and thin, from three to six hemispheres or other pieces are hollowed together, the outer piece is cut as a hexagon or octagon, and its angles are bent over to embrace the inner pieces, before the process of hollowing is begun, and which scarcely consumes more time than for one only. This is a general practice in hollowing tin work, such as the covers of sauce-pans, as the number of thicknesses divide the strength of the blows; the several pieces are then twisted round at intervals, so as to arrange them in a different order, which mixes the little imperfections, and tends to their mutual correction. The raising process, represented in Fig. 16, is also performed upon two or three pieces at a

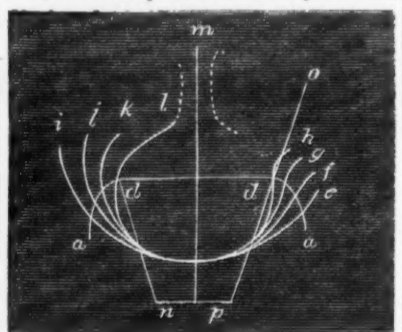


Fig. 17.

time when they are sufficiently thin to permit it.

One of the most conspicuous and remarkable examples of raised works is the ball and cross of St. Paul's Cathedral, London. The old ball consisted of 16 pieces riveted together; the present, also 6 feet in diameter and one-eighth inch thick, was raised in two pieces only, and may, therefore, be considered to mark the improvement in the copper smiths' art in making large works, such as sugar-pans, stills, etc.

The metal was first thinned and partly formed under the tilt-hammer at the copper mills, or sunk in a concave bed; the raising was effected precisely as explained in Fig. 16, and with hammers but a little larger than usual; the two parts were riveted together in their place, and the joint is concealed by the ornamental band.

All the work is modern, and is mostly hammered up, except the cast gun metal consoles beneath the ball, which formed part of the original metallic edifice; a name to which it is justly entitled, the height being 29 feet and the weight of copper 3½ tons. The new ball and cross are strengthened by a most judicious inner framing of copper and wrought iron bars, stays, bolts and nuts, extending through the arms and downward into the building; thus adding about two tons of iron to the load of copper, and to the 38 ounces of gold used in its decoration.

Having conveyed the full particulars for raising a hemispherical shape, the modifications of treatment required for various other forms will be sufficiently apparent. Thus, below the dotted lines *a d*, in Fig. 17, the sweeps are exactly the same as in Fig. 13, but the metal rises higher from having been originally larger; in the courses *g h*, it is first kept rather thicker on the edge, and toward the conclusion it is thinned on the edge to the common substance, and curled over by hollow blows from within, although the whole figure might be produced by external blows, but which would be a more tedious method.

On the other hand, by the continuance of the raising-in, explained by Fig. 16, the metal would be gathered into a smaller diameter through the steps *i, j, k, l*, in the latter of which the metal would become thickened, unless the solid or thinning blows were allowed to predominate. If enough metal had been given in the first instance, when the mouth had been so contracted to the form of a teapot, it might be extended upward as a cylindrical neck, in the manner explained in Fig. 10, and curled over at the top, as on the opposite side of Fig. 17, at *h*. To lessen the labor of raising works from a single flat plate, soldering is sometimes resorted to.

Vases in the shape of an earthen oil jar, or of the line *l d n*, Fig. 17, could be made from a cone, such as *o p*, with a bottom soldered in; these preparations would save the work of the

hammer, although such forms, and others far more difficult, could be raised entirely by the hammer from a flat piece of metal.

Should any of the above vessels require a solid thickened edge or lip, beyond that which would result from the drawing in of the metal, it would be necessary to select a piece of metal of smaller diameter but thicker, and to retain the margin of the full thickness by directing all the blows within the same; sometimes, on the other hand, works require to be thinned on the edge; these are then cut out proportionally smaller than their intended sizes.

In cases of extensive repetition, or where large numbers of any specific shape are required, expensive dies of the exact forms are employed; but these are only applicable to objects in small relief, and to those in which the parts are not quite perpendicular.

Stamping is very common for many works in brass, but which would be inapplicable if the pieces had perpendicular and lofty sides. Such lines, although rounded by the successive thicknesses of metal, would still present perpendicular sides, and therefore render this mode of treatment with dies impracticable, without reference to cost. Thimbles are raised at five or six blows, between as many pairs of conical dies successively higher, but the metal requires to be annealed every time.

North Georgia Iron Ore.

A correspondent writing from Cartersville, Georgia, to the Cincinnati Gazette, says:

From Ringgold to Cartersville, about seventy miles, on both east and west of the railroad, but chiefly west, and ranging from two to twenty miles from its line, are hundreds of beds of iron ore (brown hematite) of great purity and richness, some immense hills or small mountains containing millions on millions of tons. It is these beds of ore which must make this region in the future one of great wealth and prosperity, coupled as they are with an excellent soil and good timber, and will be with easy transportation.

The question has arisen, Will it pay to ship these ores North? In 1873 the experiment was tried from Alabama and proved a financial loss. A Pittsburgh ore man lately traveling through this region has given a solution of the matter worthy of being noted. He says it is simple want of cleanliness of the ore, the transportation of so much matter that is not iron. Take for instance this place, which, by your Southern road, will be 411 miles from Cincinnati. In three miles of the railroad here is a vast hill of ore, over 200 feet high, and its base covering forty acres of ground. This ore has been used in the Rogers furnace, roughly washed, and has averaged 60 per cent. of metallic iron, the furnace books say 63; now a siding from this Lugton Hill to Cartersville would enable the operator to put his ore in this place at a total cost of not over \$2, including profit. It can be mined almost so easy as limestone can be quarried in Pennsylvania, and if slack can be gotten at the mines, where it is in the way, for freight and handling, say six cents per bushel, or even at ten cents, then we have

Mining ore, 25 cents per ton, 100 tons.....	\$25 00
Eighty bushels of coal to roast 100 tons.....	8 00
Handling and wood.....	12 00
Contingencies.....	5 00
Total.....	\$50 00
Result 80 tons of ore free from water and impurities, and so concentrated as to analyze full 75 per cent. of metallic iron, or, as my Pittsburgh friend says, to yield at least 75 per cent. in a blast furnace. Hence we have:	
Cost of 80 tons at the mines.....	8 62½
Cost of 80 tons to main track, say.....	37½
Profit.....	1 00
Freight to Cincinnati.....	4 00
Handling at Cincinnati.....	50
Total cost per ton at Cincinnati.....	\$6 50

Now we have delivered at Cincinnati an iron ore just as neutral and as free from any character of impurities as any in the world, for many of the limonites of this region have no sulphur and mere traces of phosphorus, sometimes not that, at a cost of \$6.50 per ton, profit included. It can be sent to Pittsburgh by water from Cincinnati for \$2, making \$8.50 for an ore just as good, and which will yield in the furnace just as well as Iron Mountain of Missouri or Lake Superior, which is \$12 even now. The freight to Cincinnati is placed low, but the road will have hundreds of cars coming down here loaded with bacon and wheat, and corn and flour, and they will have to go back empty or take back freight cheaply. Then the Cincinnati Southern has better grades than any other road running from the West or North to the South, and can afford to take freight more cheaply.

The Coal Famine.—A valued correspondent sends us the following items of interest: The Pennsylvania Steel Company are using one-quarter coke in their anthracite furnaces. For a while they used one-half, but the low blast was not sufficient to operate the hoists. They are now utilizing the hoists to require less power, and Maj. Burt, the superintendent, says they will not hesitate to use all coke, if necessary. The weather and other conditions are not favorable to a fair comparison of the relative economy or production. One of the Paxton furnaces, at Harrisburg, an old stone stack, has blown out. The Temple Iron Company, of Temple, Berks county, expected to blow out three furnaces on the 4th instant for want of coal. The Millerstown and Tipton furnaces blew out on the same date, and for the same reason. These three stacks have all been put in operation within the past eight months, and are located on the East Pennsylvania R. R.

A French journal gives the following method of preparing tin for tinning brass, copper and iron: Melt the metal in a crucible which has previously been slightly warmed, and at the moment the metal begins to set, and when it is very brittle, pound it up rapidly, and when quite cold pass it through a sieve to remove any large particles that may remain.

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 upon circumstances.
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 phorus in Iron or Steel..... 12
 For each additional constituent of usual occur-
 rence..... 4 0
 For the per cent. of Carbonate of Lime, and In-
 soluble Silicious Matter in a Limestone..... 10 00
 For each additional constituent..... 2 00
 For the per cent. of Water, Volatile Combust-
 ible Matter, fixed Carbon, and Ash in Coal..... 12 50
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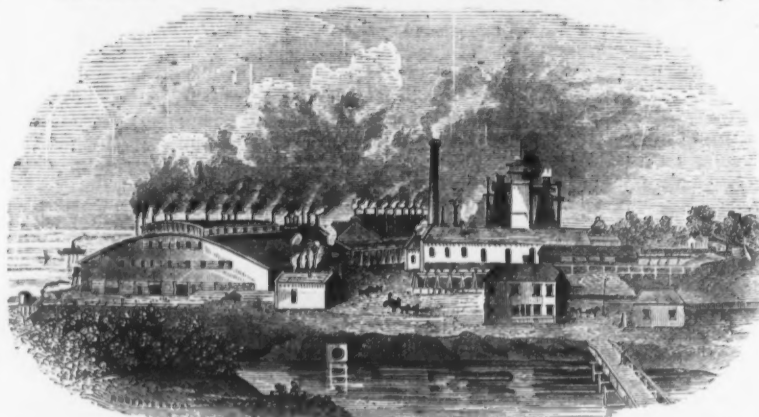
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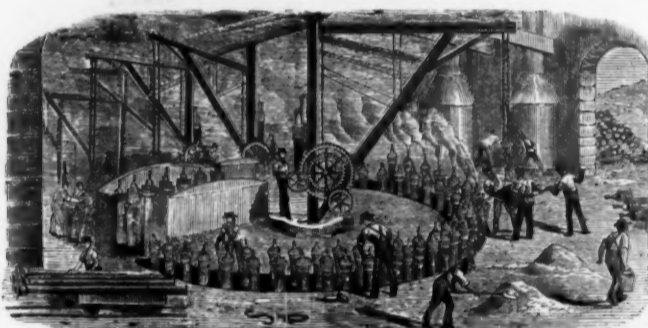
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It has been ascertained by actual inquiry that there are not less than eight thousand puddling furnaces in work throughout this country at this moment. The collateral branches of forging and fashioning wrought iron involve the existence of nearly double this number of furnaces. Fifteen tons of coal per week is about a fair estimate of the average consumption for each furnace. Thus, allowing a margin for stoppages for repairs, and for other sources of idleness, it will be found that in the furtherance of these great branches of our national industry, nearly ten millions of tons of coals are annually used.

A glance at these simple but comprehensive and reliable statistics will at once demonstrate the magnitude of the interests—monetary and industrial—involving in the important section of work to which they refer. Further consideration cannot fail to suggest, also, the desirability of lessening by every available means the enormous amount of fuel consumed. Metallurgists, chemists and engineers have, indeed, devoted during the last few years very much of enlightened attention, and assiduous labor to the question of economizing fuel generally, and their exertions have been crowned with a certain measure of success. Still it is a fact, that so far as puddling furnaces and others connected with the manufacture of wrought iron are concerned, they remain pretty much as they were forty or fifty years ago. As a rule, under existing circumstances, the amount of heat taken up by a charge of iron constitutes but a small portion of the whole heat generated by the furnace. The remainder passes off into the atmosphere. It is true that the escaping products of combustion are in some cases passed through boilers, thus leaving behind them a few units of heat for the generation of steam; but, in the main, those products are wasted on the desert air without check of any kind.

Efforts have been made of late—and notably by Dr. Siemens and Mr. Crampton—to remedy this unsatisfactory state of things. To the first-named gentleman must be awarded the credit of being, as it were, the pioneer of furnace economy. He has taught and illustrated the value of regenerating, and that very high temperatures are possible, practicable, and economical. Yet the regenerative gas furnace has not made headway amongst iron masters. It has met with the most faint praise or encouragement at their hands, and is apparently not destined—however ingenious and effective—to supersede, largely, the old reverberatory furnace.

The coal dust system of Mr. Crampton, for raising high temperatures, economizing fuel, and at the same time, minimizing the evil of oxidation in rotary puddling furnaces, has been for some time under process of experimentation at Woolwich Arsenal. A certain amount of success has been at present attained, and there is reason to expect more advantage in the future. Mr. Crampton's mode of injecting the fuel into the furnace, and thus promoting combustion in the immediate region of the metal, without the aid of fixtures or fire grates, allows of the absolute closing of one end of the revolving barrel, whilst a stream of water, by means of a double way pipe, placed in line with the axis of the latter, is made to circulate throughout every portion of the external surface of the furnace. Thus a nearly perfect equilibrium of temperature through the machine is maintained during the process of puddling. This avoidance of the proximity of great heat to the mechanism for rotating the furnace which Mr. Crampton has effected, and which evil has been the bane of all other contrivances for mechanical puddling, is undoubtedly a valuable point gained. The violent and constant alternations of expansion and contraction, which have torn other apparatus for similar purposes to pieces, cannot take place in the Crampton furnace. Possibly, therefore, the "coal dust system" may eventually be in the confirmation of rotary puddling as a permanent institution.

It is highly to the credit of the authorities of the Royal Arsenal at Woolwich that they are giving every possible attention to the momentous question of making good iron, and economizing fuel in the process. For many months past experiments have been conducted at that place with these laudable objects in view, and the results are certain to be of infinite value. One of the principal aims of those who have so zealously been working at Woolwich has been to prevent oxidation going on whilst the metal was under the influence of extremely high temperatures. This, it will be manifest, is a thing of vital consequence, for vain would be the economization of fuel if it were attended by a corresponding loss of metal. At present the best results effected by ordinary puddling furnaces prove, that on every ton of iron puddled, 10 per cent. must be charged for loss by oxidation, and this before it reached the condition of bars. Now, as the annual make of wrought iron in Great Britain is, in round numbers, three and a half millions of tons, it is clear that three hundred and fifty thousand tons of metal are yearly wasted, or returned to the normal state of an oxide. Here, then, there is ample room and verge enough for improvement. Oxidation, indeed, means something more than mere waste. In puddling furnaces, where the "cutting" action, under high temperatures, prevails, the iron is not only burnt, but permeated with cinder, and thus rendered bad.

Regarded, therefore, from whatsoever point of view it may, the prevention—or, at all events, the reduction of oxidation to the most extreme degree possible—is a point to be striven for unceasingly. During the attempts made at the arsenal to accomplish the desideratum, many interesting and peculiar phenomena were observed and recorded. They, however, need not be referred to further in this place. We wish rather to attract the attention of our readers to

realized facts and substantial results. These facts and results cannot fail, as it is believed, to gain consideration from all who are concerned, directly or indirectly, in the vast iron industries of this and other countries. In the royal gun factories department at Woolwich very much of the work to which we refer has been carried on, and is now in full operation. A grate furnace of the old style has been modified and utilized for the improved duty it was expected to perform.

In this furnace a new chamber was added at the rear of the existing fire chamber. This arrangement compelled the fire-bars to occupy a position in the middle, instead of being at the end of the furnace. The additional chamber is really formed as an upcast for the escaping products of combustion, which are conveyed into it from the opposite end of the furnace, and by means of a subterranean flue. In the upcast chamber is placed a conical retort, supported in a central position on a brick pillar, and surrounded by an open space through which the gases freely circulate. The retort, which is 10 feet in height, is of cast iron, and on its upper extremity rests a hopper, by aid of which the retort may be charged at will. A damper prevents the access of air or the escape of gas. The retort is provided with what may be termed two necks, one leading into the combustion chamber, through which the fuel is passed on to the fire-bars, and the other, on the opposite side, opening to the end, through which stoking irons or a mechanical apparatus can be applied for forcing the fuel, when needful, on to the fire-bars. The mode of lighting the furnace is to place wood on the grate-bars and kindle the fire in the ordinary way. Then the generated gases passing off find their way into the vicinity of the retort, which latter, by the time the furnace is lit for charging, will be found to have attained to very nearly a red heat.

When this is really so, the retort is charged with fuel and allowed to remain for some two or three hours. Then the stocking commences at the lower end of the retort, and the incandescent material—originally coal, but now converted into coke—finds its way gradually on to the fire bars. The law of gravity brings down more and more of the fuel, and fresh supplies from the hopper feed the retort at its upper end or mouth. Thus the fuel in the retort is deprived of its gaseous elements, and coked by the agencies which in other cases would pass off idly through the chimney stalk—namely, the waste products of the furnace. About 25 per cent. of the fuel reaches the gaseous stage at a comparatively low temperature, namely 1000° Fah. The hydrogen and hydrocarbons, which in the charging of raw fuel are either imperfectly consumed from want of air and heat, or mix their equivalents at the wrong place to be serviceable, namely, in the flue or the stack, are here absolutely utilized in their entirety.

The main purpose of the retort is really to separate the distinct properties of the fuel from each other, and then admit the resulting elements into the furnace under the most advantageous circumstances. Then the coke, first heated to redness, enters the fire in a condition to promote and support combustion, and so not a particle of the fuel, gaseous or solid, can possibly be wasted. Here, then, we see the saving of fuel exemplified in the most striking and complete manner, and in strict accordance both with scientific principles and natural laws.

While awaiting further and official information as to quantity of product and other details, we summarize for our readers the report we have received of what has been effected in the arsenal during the past few months with furnaces, on what may be denominated the "retort" plan, as compared with the results of common practice outside that establishment.

During a period of ten weeks of continuous night and day work, the single retort furnace at Woolwich produced, of puddled iron, 1 ton for every 13 cwt. of coal used. In the ordinary single puddling furnace, as used out of doors, the consumption is at the rate of 24 cwt. of coal per ton. This exhibits a saving of 45 per cent. of fuel in favor of the arsenal. Again, a reheating furnace working at the latter place for six months gave results, comparing with the common furnace, in the proportion of 4½ cwt. to 8 cwt. of coal per ton of iron, or a saving of 43 per cent. The double puddling furnace, on the retort principle, showed an advantage of 42 per cent. over the common furnace of a like kind.

As a rule the waste in a common puddling furnace, even with best of fettling, may be taken at 5 per cent. for a single furnace, and 10 per cent. for a double furnace, the larger capacity being conducive to oxidation, owing to the greater exposure of the "heat" to the influx of air from the working holes in baling up.

The waste in the single-retort puddling furnace, has been uniformly found to be less than 2½ per cent. of iron, and in the double-retort furnace it has proved to be below 5 per cent., whilst the fettling used in the single furnace was 6 per cent. against 8 per cent., and in the double, 4 per cent. against 6 per cent.

This, with coal at 10 per ton, and fettling at 80, would effect a saving in each class of furnace of from 10 to 12 per ton of puddled bar, on the materials employed in producing it. The saving, nevertheless, does not end here. The retort furnaces, themselves, from their peculiar construction, the more perfect combustion of the gases within them, their freedom from fluctuations of temperature, as well as from other minor causes, are far more durable than those constructed on the ordinary plan.

Another great point to be gained by and by, as it is expected, will be further economy resulting from the heating of the blast to a greater extent than at present. The Woolwich experimenters have not hitherto heated it to above

300° Fah., yet this has been sufficient to make manifest the economy of the practice. It is also intended, if found practicable, to introduce mechanical puddling. Thus, heated air, preheated fuel, larger capacity and labor saving arrangements will all be concentrated and combined, so as to ensure a yet greater economy of fuel, and the production of better iron. Then, by adopting the continuous working on the three-shift system in addition, the Woolwich authorities are sanguine of being able to produce fifty tons of iron puddled per week, with possibly 8 cwt. of coal and 2 cwt. of fettling per ton.

A Cincinnati Bolt and Screw Factory.

The Cincinnati Trade Review says:

The firm of Hotchkiss & Gaylord, of this city, was organized in the autumn of 1874, for the manufacture of machine, bridge and plow bolts, and the business was commenced in the month of October of that year, works having been erected on the "Flats," near the Cleveland Iron Company's Rolling Mill. Though the condition of business affairs at that period was not altogether auspicious for the inauguration of a new enterprise of any character, still the new firm entered upon their undertaking confident of their ability to command a market upon the merit of their work, which it was a part of their design should be unsurpassed. It is a fact in the experience of every business man that there is always "room for one more," if that one is able to successfully compete in the quality and excellence of his wares, and the experience of Messrs. Hotchkiss & Gaylord illustrates this fact. In the face of the depression in all portions of the country, the firm has experienced a steady progress in its business, until what might have been conceived by some at the outset to be in some degree an experiment, has become a permanent entity, with most flattering promise for the future.

The works of the firm consist of a building 110x50 feet, embracing a forging room, 50x50 feet, a finishing room 60x50 feet, and apart from these an engine room 20x30 feet. In the forging room are four heading machines and two presses, and in the finishing room, five cutting lathes, two pointing lathes, two tapping lathes, engine lathes, planers, etc. The engine is of 35 horse-power, and all the machinery is run by steam. The machinery employed is all of the most modern pattern and make, the larger portion having been made to the order of the firm. The present capacity of the works is equal to the production of from 25,000 to 30,000 finished bolts daily, and about 2000 pounds of screws; but the firm are contemplating the addition of machinery which will increase the capacity of the works, the necessity for such increase in the near future being pretty well assured. At present employment is given to 30 hands. The market for the goods is not limited to any particular locality, but extends to all parts of the country, and to Canada, and is steadily widening.

The works are under the immediate supervision of Mr. C. A. Hotchkiss, late of the Plant Manufacturing Company, of Plantsville, Conn., who has a practical knowledge of the business acquired through the experience, as workman and manager, of a score of years of active employment. Mr. Gaylord has been during the greater portion of his life connected with manufacturing enterprises, having latterly been associated with the Collins Axe and Tool Company, of Hartford, Conn., the most extensive establishment of the kind in this country, if not in the world. The business is therefore in capable and experienced hands, and with a foundation of ample capital, and a reputation and character already well established and widely extended, the continued prosperity and progress of the firm is assured.

Recognizing the Facts.—The London Mining Journal has been publishing a series of articles on the iron ore region of Lake Superior and other portions of the United States, from one of which we extract the following: "The constant extension of industrial enterprise in the United States, and the vastness of the American coal deposits, have naturally caused British iron masters to regard America as the country from which most active competition with English iron in the markets of the world is to be expected, and the abundance of the iron deposits, and their distribution throughout the various parts of the Union, certainly appear to justify that feeling. The mineral wealth of iron in the United States has never been appreciated, either at home or abroad, though it is claimed that at the present day no more judicious or profitable investment of capital can be made in the world than in the iron ore lands of the United States. For centuries to come the abundance of ores cannot be exhausted, nor that of the fuels to reduce them. At the present prices of iron—prices which, for a series of years, cannot, under ordinary contingencies, decline—there is a lucrative and legitimate business in the manufacture of pig iron when the proper localities are selected, and the control of sufficient ore is secured. To the ore regions of the Northwest and West, as yet comparatively virgin regions, must the cheap future supply of pig metal be looked for. No known variety of iron ore commercially used can be mentioned of which the counterpart has not been found in some section of the United States. The whole Lake Superior region of Michigan abounds with magnetic and hematite ores of the choicest description."

The Continental Iron Trade.—According to the *New Free Press*, the iron trade is very much depressed, and the tendency of prices is to go downward in all Continental countries, save Russia. Even in Sweden, where in consequence of the peculiar quality of its iron, affairs have been hitherto brisk, the prevailing dullness is now making itself perceptible. It is only in the imperial and private establishments of Russia that full activity is still seen, the extensive railway operations in that empire being the sufficient cause; indeed, a large part of the current business in England, Germany and France consists of exports—principally of railway metals—to Russia.

Reasons for Using our Goods.

Hogs when ringed are prevented from rooting, and fatten quickly.

Pastures and clover fields are kept smooth and are not destroyed by the hogs rooting them up.

Feed lots in the winter are kept smooth, and corn that is otherwise rooted and tramped into the ground is saved.

The **Triangular Wire Ring**, manufactured only by us, is the only wire ring that can be inserted in the hog's nose with one grip on the **Ringer**, and is the only ring that will remain in a hog's nose, as it fits close, will not turn in for the joint to irritate the nose, is not liable to be torn out, and heals quickly.

No puncturing of the nose required to insert our ring.



For Sale by the Leading Jobbing Hardware Houses of New York, Philadelphia, Baltimore, Cleveland, Columbus, Cincinnati, Dayton, Indianapolis, Lafayette, Chicago, Milwaukee, Burlington, Davenport, St. Louis and San Francisco.

SOMETHING NEW.

We shall this present season make a **Heavy Tinned Wire Ring** that will not rust in the hog's nose. The strongest and best ring in the market.

Prices.

Ringers, retail.....	\$1 00
" per doz.....	6 00
Rings per box (100) coppered wire.....	50
" per doz boxes (1000).....	3 00
" per box (100) tinned wire.....	60
" per doz boxes (1000) tinned wire.....	4 00
Tongs or Holders retail.....	1 25
" per doz.....	9 00

The coppered wire ring will be sent unless otherwise ordered.

Samples by mail postpaid on receipt of retail price.

Goods sent C. O. D. with privilege of examination before paying charges.

Net prices in quantities, circulars and posters mailed free.

Our advertisements are now inserted in over 1800 newspapers, published in every State of the Union, so that dealers will find a large demand created for our goods.

THE NICHOLSON FILE.

All *Nicholson Files* are cut with the **Patent Increment Cut**, an invention owned and controlled exclusively by us, the file cut in this manner being Patented as a new article of manufacture, and differs from all other machine cut files (all of which have their teeth cut with equal spaces) by being cut with teeth slightly *expanding or increasing in size and space from the point*, thus avoiding the too great regularity of teeth common to all other machine cut files. The tendency of all cutting tools with teeth or cutters placed at regular distances from each other may be illustrated (to the machinist at east) by the fluted reamer—as it is well known that if a round reamer be made with (say 12) teeth whose spaces are equidistant, the hole reamed will *not* be round and smooth, but will approximate to a hexagon in shape. Whereas, if the same number of teeth be made of irregular distances, the hole reamed will be both round and smooth. The same is true of a file, hence the necessity of its having teeth at unequal distances, and to which we have applied the name of **Increment Cut File**, which possesses all the advantages of hand cut work, and the accuracy and uniformity of machine work. It is now upwards of seven years since this File was introduced to the public, and the demand has increased until our production is undoubtedly treble that of any File manufactory in the country.

We put all files under seven inches in boxes of either one-half or one dozen each. These boxes are neatly arranged, and open on the end, on which the kind is plainly marked with printed labels, acknowledged improvements on the old methods.

The *"Increment File"* is not an experiment, but an established fact, and already has acquired a legitimate demand or upwards of 500 dozen per day. We employ no *regular Travelers*, but our goods may now be found in the hands of the principal jobbers and dealers throughout the country.

Prices and terms will be forwarded on application to

NICHOLSON FILE COMPANY,
Providence, R. I.

USE THE BEST.



Pawtucket, R. I.

The American File Company have the exclusive right to use the Bernot process for cutting files. By this method all the advantages of hand cutting are secured, together with an accuracy unattainable in hand work. They are the only manufacturers who employ machinery for testing files and steel.

Goods of all known manufacturers have been repeatedly tested, and interesting tables have been compiled showing the working qualities of files made by different makers, and of files made from different steels, and with various shapes and angles of tooth. They have thus reduced the manufacture of files to an exactness and perfection with a uniformity of result, as they believe, never before attained. No file, foreign or domestic, that they have ever tested, has equalled the performances of their own goods taken at random from their stock. Their machines are capable of the most delicate adjustment, and can produce the very finest work known to the trade. Special files made to order. Prominent file manufacturers are having their best goods from our works.

Price lists and information furnished on application.

AMERICAN FILE CO., Pawtucket, R. I.

FILES
AND
RASPS.
IMPORTED STEEL
BY THE
Auburn File Works,
AUBURN, N. Y.

JOHN ROTHERY'S
Celebrated Hand-Cut FILES,
Made of Best English Cast Steel.

WALSH, COULTER & FLAGLER, Sole Agents,
83 Chambers and 65 Reade Streets, N. Y.

EDWARD PHELAN,

Surviving Partner of W. F. SHATTUCK & CO.,

No. 113 Chambers and 95 Reade Streets, New York,
MANUFACTURER OF AMERICAN HARDWARE.

Cross & Taff's Pat. Wrenches.
Axe, Pick, Sledge & Hammer
Handles.
Gimlets and Gimlet Bits.
Augers and Auger Bits.
Coconut Nut Dippers.
Wire Nerves.
Scale Beams.
Patent Tap Wrenches.
Brundage Horse Nails.
Mazure's Wrt Iron Goods.
Shattuck's Platform Counter
Scales.
Law's Cow Bells.
Axe, Picks and Hatchets.

DEAN'S New Patent (1873)
Screening Scoop
SHOVEL

For Coal, Coke and Coal
Ashes, and other
Substances.

The largest frames are 12 by 15
inches, with seven bars, and are
made of the Best Malleable Iron.
They are, or can be, wired
between bars by an arrangement of
holes a quarter of an inch apart,
by an ordinary person, to screen
any size substance desired. They
are warranted to be the most du-
rable and practical Screening
Shovel made, or money refunded.
Reference—All New York Gas
Companies and Hotels.

Smaller sizes on hand.
Please address orders to
A. SEE & SON,
N. Y. Shovel Works,
1358 Broadway, N. Y.
Price: Largest size \$20 per doz.,
and upwards, according to size of
spaces.

Clement & Hawkes Mfg. Co.,
Manufacturers of
SHOVELS,
Planters' Hoes, Trowels and Machinery.
Northampton, Mass.
Send for Circular and Price List.

Schweitzer Mfg. Co.,
57 Reade St., N. Y.
IMPORTERS & JOBBERS.

"CHAMPION" Hog Ringer and Rings.



The only Ring invented that will effectually prevent Hogs from Rooting.
Being a Double Ring it is equal to two or three of any other Ring. Having no sharp points in the flesh it does not cause irritation or soreness as in other Rings. The smooth part of the wire being in the nose, it heals rapidly. One of our rings being equal to two or three of any other ring, makes this ring cheaper than the cheapest ring in the market. Time and money saved in using the Champion Hog Ringer. One operation and the work is done.

Price of Hog Ringer, 75c. each.
Coppered Hog Rings, 50c. per 100. | Price of Tinned Hog Rings, 60c. per 100.
Hog Holder, 75c. each.
Discount to the trade.

CHAMBERS & QUINLAN, Exclusive Manufacturers,
DECATUR, ILLINOIS.
Original Manufacturers of Tinned Rings.

Established 1816.

Peter A. Frasse & Co.,

95 Fulton Street, New York,

SOLE AGENTS FOR

Thomas Turner & Co.'s Suffolk Works,
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FILES AND HORSE RASPS,

And Importers of

STUBS' FILES, TOOLS & STEEL,
W. J. Davies' Sons' London Emery Cloth,
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EVERY FILE WARRANTED.

Equal to the
BEST.

Western Files.
Works, Beaver Falls, Pa.

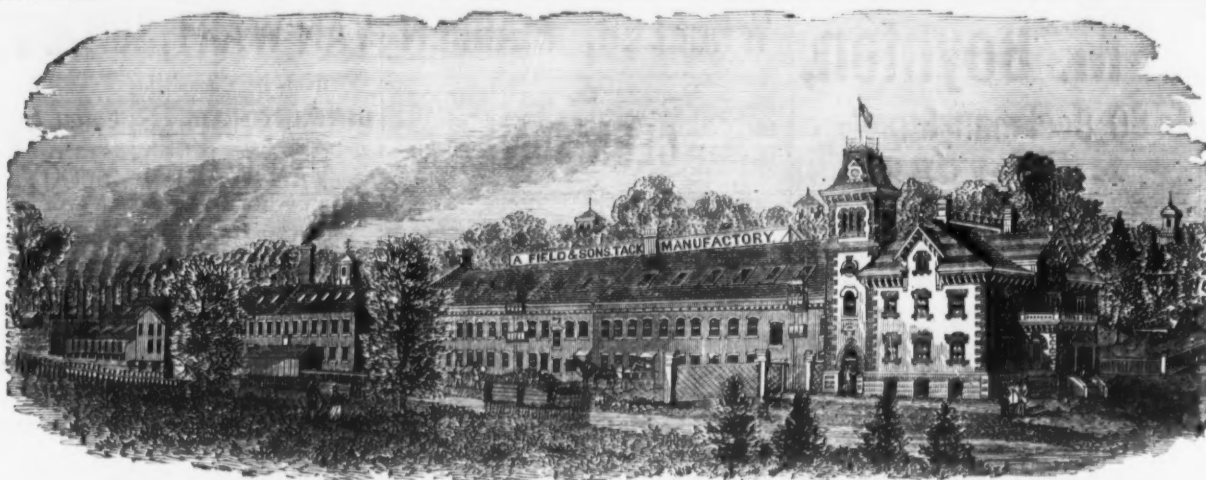
Western Files.
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LARGEST CAPACITY
Of any File Works in the World.

In the face of strong prejudice against American files, this brand has earned a reputation second to none. The trade in all sections testify to their excellence. We confidently offer these files as superior in every respect and cheaper than any first-class file in the market. A trial will confirm their reputation.

McKINNEY MFG. CO., Hamilton, O.

Wrought Butts,
Strap & T Hinges.
Send for special discount
sheets.



A. FIELD & SONS,

TAUNTON, MASS., Manufacturers of

Copper and Iron Tacks, Tinned Tacks,

SUPERIOR SWEDES IRON TACKS, for Upholsterers' Use, Saddlers' Supply, Card Clothing, etc., etc.

American and Swedes Iron Shoe Nails,

Zinc and teal Shoe Nails, Carpet, Brush and Cimp Tacks, Common and Paten Brads, Finishing Nails
Annealed Trunk and Clout Nails, Hob and Hungarian Nails,

Copper and Iron Boat Nails, Paten Copper Plated Tacks and Nails
Fine Two Penny and Three Penny Nails, Channel, Cigar Box and Chair Nails, Leathered Carpet Tacks,
Glaziers' Points, etc., etc.

OFFICES AND FACTORIES AT TAUNTON, MASS.

WAREHOUSE AT 35 CHAMBERS STREET, NEW YORK, where may be found a full assortment of Tacks, Brads, &c. for
the accommodation of the New York Wholesale and Jobbing Trade.

Any variations from the regular size or shape of the above named goods made from samples, to order.

OTIS PASSENGER —AND— FREIGHT ELEVATORS

FOR HOTELS, OFFICE BUILDINGS, STORES,
WAREHOUSES, FACTORIES, MINES,
BLAST FURNACES, &c.

OTIS BROTHERS & CO.

SOLE MANUFACTURERS,
348 Broadway, New York.

EMPIRE PORTABLE FORGES

NO BELTS, BELLOW OR CRANKS
The Best Made.

Send for Catalogue to the
Empire Portable Forge Co., Troy, N. Y.

THE CANADIAN BANK OF COMMERCE.

Capital - \$6,000,000, Gold.
Surplus - \$1,800,000, Gold.

The New York Agency, 50 Wall St.,

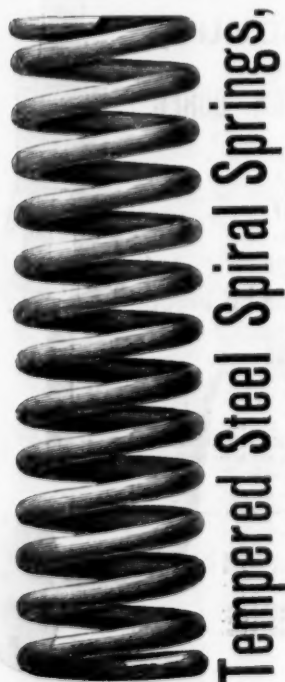
Buys and sells Sterling Exchange, makes Cable
Transfers, grants Commercial Credits, and transacts
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J. G. HARPER, Agents.
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TACKLE BLOCKS

BURR & CO
Manufacturers of Waterman and Russell
PATENT IRON STRAPPED BLOCKS

ALSO MANUFACTURERS OF
ROPE STRAPPED BLOCKS,
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Tempered Steel Spiral Springs,

Of all sizes and descriptions, made to order by
JOHN CHATILLON & SONS, 91 & 93 Cliff St. N. Y.
Our Springs are used by the U. S. Government, and various Military,
Naval and other Scientific Institutions.

CROCKER BROTHERS,

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METALS.

Anthracite Pig Irons,
COLD AND WARM BLAST CHARCOAL IRONS,

American and English Bessemer Irons, Iron Ores.

COPPER, TIN, &c.

Advances made on Merchandise.

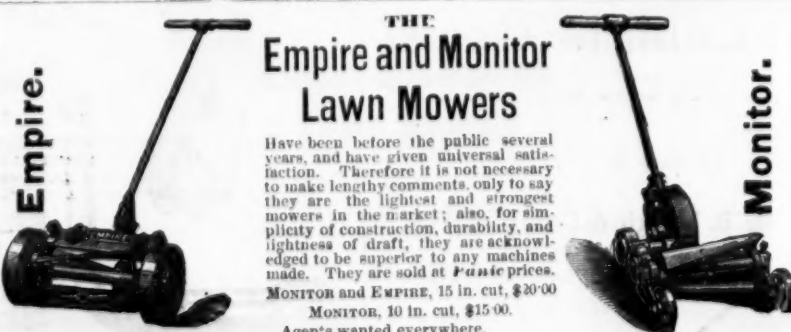
Yale Mortise Night Latch No. 70.

WITH CAP REMOVED SHOWING
INSIDE OF LOCK.



Yale Lock Mfg. Co.,

No. 298 Broadway, NEW YORK. STAMFORD, CT.



THE Empire and Monitor Lawn Mowers

Have been before the public several
years, and have given universal satisfaction.
Therefore it is not necessary
to make lengthy comments, only to say
they are the lightest and strongest
mowers in the market; also, for simplicity
of construction, durability, and
lightness of draft, they are acknowledged
to be superior to any machines
made. They are sold at *reduced* prices.
MONITOR and EMPIRE, 15 in. cut, \$20.00
MONITOR, 10 in. cut, \$15.00.
Agents wanted everywhere.
MANUFACTURED BY

BARLOW & WALKER, Sing Sing, N. Y.

BUSINESS ITEMS.

PENNSYLVANIA.

The Philadelphia Engineer, of the 5th instant, says: Rieble Brothers, proprietors of Philadelphia Scale and Testing Machine Works, are now repairing for the Pennsylvania Railroad Company a one hundred (100) ton railroad track scale, which was built for the Third State Road in the year 1850 (twenty five years ago), and has been in service ever since. This was one of three scales built for the same company at these works, and they were the first successful long track scales built in the country. It might be here mentioned that the first platform scale with graduated weighing beam was invented and built by the predecessors of this establishment. This firm supplies the Philadelphia and Reading Railroad, also Philadelphia and Reading Coal and Iron Company with scales. Also sells to the Pennsylvania Railroad Company. At present they are filling a large order for the Lackawanna Iron and Coal Company for scales for their new Bessemer Works, at Scranton, Pa.

The Blair Iron and Steel Company, of Blair county, are putting up a new open-hearth melting furnace, and are erecting a building for it. When this furnace is completed the capacity of the works will be 94 tons of steel ingots per week. This company's steel is manufactured from an iron sponge, made by what is called the "Blair direct process," and the demand for it is so enormous that they could dispose of 10 times the amount their works is capable of producing.

The boiler fires at the Ferndale Rolling Mill, Allentown, were started last week, and it is probable that the mill will resume operations shortly.

The Locomotive Shops of the Dickson Manufacturing Company, at Scranton, were destroyed by fire February 28th. Loss, \$500,000; insurance, \$85,000. Two hundred and fifty men are thrown out of employment by the burning of this establishment.

Bowman's rolling mill, at Lebanon, is making fine sheet iron at the rate of forty-five tons per week, and employing sixty workmen. On Monday the force will be increased to one hundred men, and about eighty-five tons manufactured weekly.

Forty-eight colored boilers, from Danville and Richmond, Va., have been engaged to take the places of the men at the Pittsburgh Bolt Works, near Soho, who refused to work at the wages offered by the proprietors.

Pott's Bro.'s Rolling Mill, at Pottstown, has resumed operations on a two weeks "run," at the end of which a longer "run" is expected to be announced.

OHIO.

In 1874 Akron manufactured 600 tons of stove and hollow ware, 400 tons of bar and railroad iron, 3,476,600 gallons of stoneware, two portable saw mills, 400 plows, 50 tons of wheels, and 700 tons of other castings, 5242 reapers and 1904 mowers.

Coppas Brothers, of Medina county, have purchased the Freer Rake Factory, in Orrville, of Jacob and Christian Brennenman, and will engage in the manufacture of a new improved threshing machine. The citizens contributed \$1000.

The round house of the Cincinnati, Sandusky and Cleveland Railroad, at Springfield, was burned March 1, with five locomotives and the machine shop adjoining. Estimated loss \$50,000 to \$70,000. Buildings insured for \$7500; insurance on contents not stated.

The Milburn Wagon Company, which has just completed the erection of extensive works at Toledo, will prove a most important addition to the manufacturing industries of that city. The productive capacity of the shops is equal to the manufacture of 30,000 wagons a year, or one wagon in eight minutes. This can be increased to 30,000 per annum with but slight additions to the machinery, and none to the buildings. The making of the 30,000 wagons requires the service of 500 operatives. It will require 5,000,000 feet of lumber to supply the factory, and 6,000,000 pounds of iron. The cost of these buildings was \$130,000, and of machinery, \$50,000. The company now manufacture freight, farm and spring wagons, and during the coming season will begin the manufacture of buggies and express wagons. The management of the company is invested in the following gentlemen: George Milburn, president; J. H. Whitaker, vice-president; G. R. Hudson, secretary and treasurer; J. Milburn, superintendent; W. W. Griffith, A. L. Kelsey and Wm. Baker.

The Cuyahoga Falls Rivet Company is putting up an additional machine to fill increasing orders.

MISSOURI.

Messrs. Moffet & Sergeant have completed and are successfully running their new furnace at Lone Elm. The building is 70x50. There is a 30 horse-power engine to supply blast and work the crusher, jigs and pump. Additions to the capacity will soon be made.

WISCONSIN.

The iron stack of the National Iron Company, at Depere, is reported blown in.

One stack of the Fox River Iron Company, at West Depere, has been in blast about two weeks, producing steel iron for rail purposes.

Floor Construction.

Floors should be specially constructed for what they have to carry. Thus, for instance, a floor for a warehouse containing heavy goods should be much stronger than a floor which has to carry only light goods; and, again, a floor of any warehouse should be stronger than that of any ordinary private house of moderate dimensions.

This statement may seem superfluous and unnecessary to any one considering the subject from an abstract point of view, as it is obvious that the only alternative would be to build

every floor of sufficient strength to carry the heaviest goods, or the weight of the largest number of persons that could be closely packed together, or both combined, and in addition able to withstand exceptional shocks and thrusts from machinery, movement of persons goods, etc., and that on account of the expenses alone, independently of other contingencies, this alternative would be wholly out of the question.

It is, however, by no means superfluous to those who are forced to consider the subject in connection with the existing condition of buildings, and who are professionally engaged in obviating the consequences of careless and defective construction, and of those changes in the uses of buildings which are unfortunately permitted in many great cities.

The next points, after the intrinsic strength of the floors, are the nature, style and strength of their supports. A floor supported, as is frequently the case, on nothing but stone projections can never be trusted after the temperature has been suddenly raised to any considerable extent.

When the surrounding walls are of stone, a continuous stone projection all round is permissible, as the chances are against the whole splitting and falling together, but even in this case it is much safer to have a longitudinal piece of wrought iron or hard wood laid as a sleeper above the stone.

The safest description of the latter support for floors is to have a portion of the walls corbelled out in brick, which will never yield to heat, whether applied gradually or suddenly.

Floors which have a very large area, or have to carry heavy loads, should invariably be provided with central or intermediate supports, and the more these are made of some material which can resist the efforts of heat the better. For this purpose wood of any kind, but especially hard wood, is infinitely preferable to stone or iron.

Cast iron columns, in consequence of the small space they occupy, are now much used for supporting floors of warehouses and shops, where light and room are of great consequence, and their strength is usually calculated according to the weight which they are designed to carry, the breaking strain being generally considerably over the load, thus allowing a sufficient margin for exceptional contingencies such as vibration, or the falling of heavy bales of goods; but in this calculation the question of any other temperature than that of the ordinary atmosphere appears to have been lost sight of altogether, and when it is remembered that, at a temperature of 212° Fahrenheit, or the boiling point of water, cast iron loses about 15 per cent. of its strength; that, at the temperature of molten lead 612° Fahrenheit, it has probably no strength at all; and that, at a temperature of 2787° Fahrenheit, which is probably much below that of the center of a large building on fire, it becomes liquid, it seems advisable to supplement this material with some other more trustworthy in case of heat.

When it is necessary to use iron columns, they will be found much more capable of resisting the effects of heat if made solid and not hollow, as is most commonly the case.

For the purpose of support an occasional brick column would answer best, but, as there would certainly be much objection to the space it would occupy, and the consequent obstruction to light, it appears hopeless in ordinary cases to expect it to be done; however, in all others one wooden story post might with advantage be substituted for every fourth iron column. For the story post oak or elm would be the best timber to use, and the remaining iron columns might be to a considerable extent protected by plaster.

It is somewhat unfortunate that of late years the words fire-proof and incombustible have been used indifferently, and it must be acknowledged that some existing acts of legislation have given legislative sanction to the error.

These are, however, by no means synonymous terms; on the contrary, there are many cases in which combustible substances are much more proof against the fire than non-combustible, as an instance of which may be cited the acknowledged fact, proved by long experience in this and other countries, and now placed beyond doubt, that good oak or other hard wood posts with girders and joists filled well in with proper concrete prepared for the purpose come nearer to fire-proofing than any arrangement of iron combined with brick or stone hitherto brought into use.

Floors should invariably be brought in so close to the walls that there should be no possibility of either flame or smoke passing, even when the joists or other supports spring and buckle, as they frequently do during fires from the weight of either water resting on them, large bodies of men moving about, or heavy weights falling on them. Skirting boards are quite unnecessary for any properly constructed floors except for the purpose of ornament, to which these remarks have of course no reference.

The material of which floors are most commonly constructed is wood, but they may in certain cases be safely made of slate, or still more safely of brick or various kinds of concrete on supports which can resist the effects of heat. Stone is a very bad material for flooring, except when bedded on a foundation of solid earth, or some other fire-proof and non-conducting substance.

Circulation of air should on no account be permitted in any part of a building not exposed to view, especially under floors, or inside skirting boards or wainscots.

Good plaster protects wood and other inflammable materials from fire almost perfectly, and a sound pugging of plaster between the ceiling of a room and the floor of that over is practically found impervious to flame.

The floors of a building, of whatever material they are constructed, should be made both airtight and water-tight, and they would in this way resist the effects of heat much longer than if this precaution is omitted. They might with advantage even be caulked like a ship's deck, only with dry oakum without pitch.—*Fire Record.*

GEORGE GUEUTAL & SON,

39 West 4th St., New York.



Wood Screws, Steel in Sheets,

BAND SAWS, TOOLS FOR BRAZING, &c.

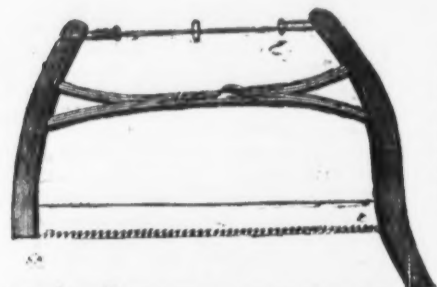
Bed Screws, Pin Hinges, and Wire Nails a Specialty.

H. W. PEACE,

MANUFACTURER OF

Saws of all kinds.

FACTORY, WILLIAMSBURGH, N. Y.



Elliptic Forked Saw Frame.

Patented June 28th, 1870.

The annexed engraving represents my ELLIPTIC FORKED SAW FRAME, which commends itself to the trade for its simplicity of construction. The Forked Frame being all in one piece, without any center bolt, secures for the Frame great strength and durability. These Frames are put up with my best Webs, marked "No. 40, Harvey W. Peace."

HARVEY W. PEACE,
Sole Proprietor & Manufacturer,
VULCAN SAW WORKS,
WILLIAMSBURGH, N. Y.

**THE SILVER STEEL
DIAMOND CROSS-CUT SAW.**

\$1.50 Per Foot.

Patent Secured

THIS new Saw, which is destined to take the place of all Cross-cut Saws in point of **SPEED AND EASE**, is manufactured by **E. C. ATKINS & CO., Indianapolis, Ind.**, who are the **SOLE MANUFACTURERS FOR THE UNITED STATES.** So confident are we that this is the best Cross-cut Saw in the market that we **CHALLENGE THE WORLD.** Orders promptly filled.
E. C. ATKINS & CO.
Saw Manufacturers and Repairers, Indianapolis, Ind.

**Lloyd, Supplee & Walton,
HARDWARE FACTORS.**

MANUFACTURERS OF

**Bonney's Hollow
AUGERS.**Stearns' Hollow Augers
and Saw Vises

Bonney's Spoke Trimmers

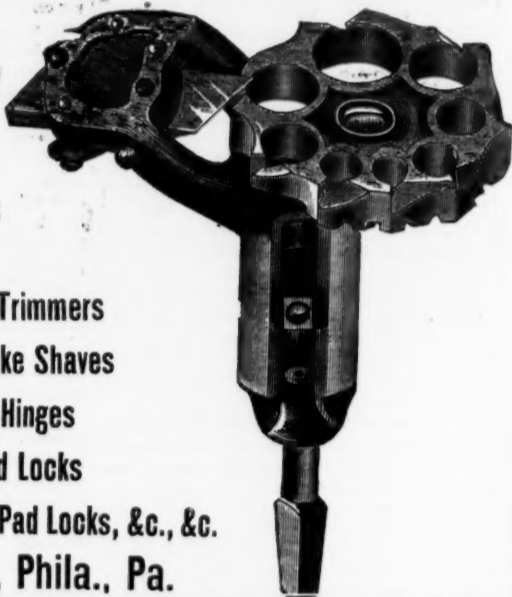
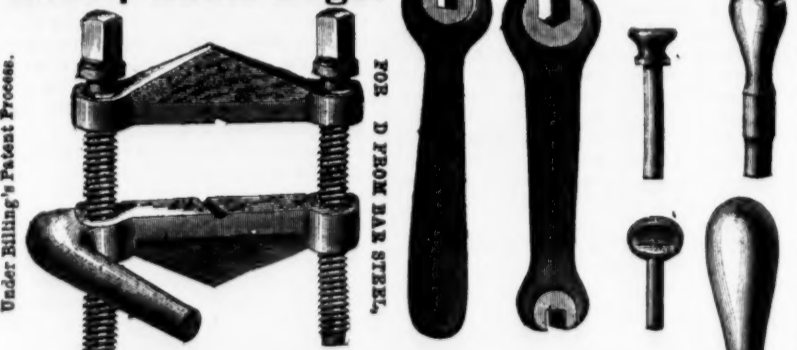
Double Edge Spoke Shaves

Adjustable Gate Hinges

Scandinavian Pad Locks

Flat Key Brass and Iron Pad Locks, &c., &c.

625 Market St., Phila., Pa.

**BILLINGS & SPENCER COMPANY, Manufacturers of
Clamp Lathe Dogs.**

And Hardened.
A First-Class Article, and something that every machinist and Tool Maker will appreciate.
WROUGHT IRON AND STEEL DROP FORGINGS
of every description. Machine Handles, Lathe Wrenches, Thumb Screws, Milling Machine Cranks, Spanners, Parts of Sewing Machines, Guns, Pistols, Drill Chucks, and MACHINERY GENERALLY.



THE BILLINGS PATENT SEWING MACHINE SHUTTLE,
Thirty Varieties now made, Forged Solid from Bar Steel and Cold Pressed. Also,
The Barwick and Wheatcroft



Patent Self-Adjusting PIPE WRENCHES, of all sizes.
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Saws of all kinds.

Also Sole Manufacturer of

LIGHTNING SAWS.

Two Direct Cutting Edges, instead of one Scraping point.



Note extra steel and durability over the old V, outlined on M tooth.

Telegram Dated Oct. 1st, 1874.

STATE FAIR, EASTON, PA.

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Philadelphia, Pa.

I want you to publicly test that challenge on Cross Cut Saws. Name time and place within thirty days. American Institute preferred. E. M. BOYNTON.

E. M. Boynton gave on Wednesday of last week an exhibition of what his Lightning Saw could do at the Pennsylvania State Fair, in which two men sawed through a sound oak log, 16 inches in diameter, in 17 seconds. Mr. Boynton informs us that his export trade is increasing, he having lately made large shipments of his saws to Australia and other distant markets.—*The Iron Age*, Oct. 8, 1874.

For fuller report of this exhibition see the *Eastern Morning Dispatch* of Oct. 1st, 1874.
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Manufacturer of

ALL KINDS OF

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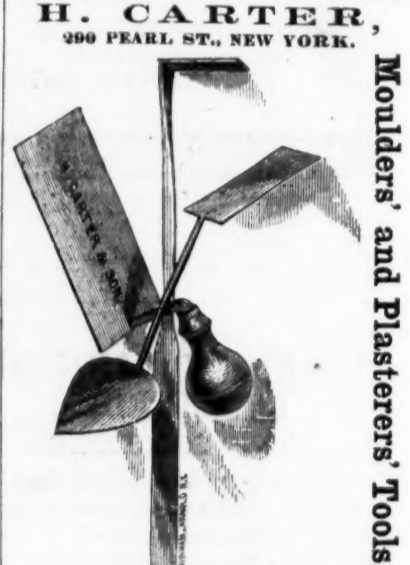
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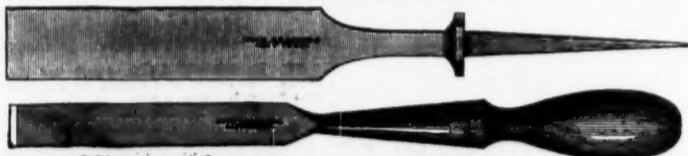
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We would call the attention of jobbers to the necessity of sending orders early in the season for the

Automatic Muzzle, which must supersede all others. It has the endorsement of Mr. Bergh, and is one of the best and most humane inventions of the age.

Manufactured by W. T. & J. MERSEREAU,
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Shelton Company,
Manufacturers of every variety of

TACKS & SMALL NAILS.
Carriage, Machine, Floor, Stove and
Tire Bolts, Coach Screws,
Bed Screws, &c.

BIRMINGHAM, CONN.

PHILADELPHIA CORRESPONDENCE.

PHILADELPHIA, March 8, 1876.

Notwithstanding that we are well advanced in the first spring month, winter weather still continues; our rivers and canals are ice locked, railroad trains in all parts of the country are snow-bound, mining and transportation of minerals is at a stand-still, and to all intents and purposes trade is as much impeded in the middle of March as it was in December. The effect of the adjournment of Congress seems to have been beneficial in trade circles. The restoration of the ten per cent. duty on iron and metals, which went into effect with the passage of the bill, will aid the industry so much as the reduction injured it, but with the small importations cannot materially affect consumption. The coal troubles seem no nearer a settlement than at our last, although, from some unapparent cause, a report is current that the miners will very shortly accept the terms of the operators and resume work. Probably an understanding exists between the parties contesting which the general public do not understand. The Pittsburgh Rolling Mill troubles have assumed new interest during the week, from the fact that colored puddlers have been introduced into the mill of the Pittsburgh Bolt Works, under guard, and not without trouble. Failing to intimidate or drive away these men, the striking boilers resorted to threats against heaters and rollers employed in the mill, and succeeded in inducing them to quit work. Owing to riotous demonstrations, at one time, two companies of military were called out, but under orders from Gov. Hartman were later dismissed. This was done in pursuance of the policy adopted by the governor that the military shall in no case be used until it is demonstrated that the local civil authorities are unable to preserve the peace. What effect the introduction of colored puddlers may have on production remains to be seen, but it is doubtful if they can be obtained in sufficient numbers to supply many mills. Further west, in the Shenango and Mahoning valleys, all the rolling mills are reported closed, which will increase the demand for Eastern muck bar, which has already experienced a sharp advance. How Pittsburgh mills can pay \$46 to \$47 per ton for muck bar, and sell bars at 2½ cents per lb., is one of the mysteries peculiar to Pittsburgh iron making. The disturbances among iron workers in the Western part of the State are supplemented by the same action by coal miners in the Eastern portions. At Hazelton, in the Lehigh region, many outrages have been committed. Firemen and engineers driven from pumps, and property destroyed. At Glen Carbon, Schuylkill county, a number of dwellings owned by the coal and iron companies have been burned. The spirit of lawlessness has extended to Westmoreland county, and a riot has occurred at the Lackawanna mines. All these things show a bad state of feeling on the part of working men, and one which cannot but ultimately redound to their individual injury. Meanwhile, an anti-monopoly convention, composed principally of delegates from labor unions, has been in session at Harrisburg, and has promulgated a platform. In this the convention somewhat unexpectedly does not oppose the bill punishing interference on the part of any organization with the rights of boys to learn trades, but protests against any law to this end which shall not also compel any employer taking an apprentice to be responsible for teaching said apprentice to be a master of his trade. This, on general principles is right, and the present bill should have incorporated some such provision. Resolutions requesting legislative inquiry into the mining and labor troubles; requesting government aid to co-operative movement; against the use of trade orders in payment, and strongly against the *bede noir* of the miner, the Reading Coal and Iron Company, are adopted. The convention, as such bodies do generally, then hopelessly mires itself in the slough of financial theories, and enunciates doctrines amounting to being currency or value, and protests against any contraction. As a political movement it has no significance, but if honest might benefit the labor troubles.

The great danger to property along river banks liable to occur from ice gorges and floods consequent upon them has called out a variety of suggestions for relief. Blasting as tried here and elsewhere seems totally ineffectual, and nothing in the way of engineering talent, as yet, offers any practical method. It would seem that the owners of such property were entitled to relief, and as if some plan for cutting away the ice mountains could be put in force, if no more than the employment of manual labor in the large numbers now unemployed.

The American Steamship Company has published an abstract of the logs of their ships, both on East and West bound passages, which shows that the average passage East bound from Cape Henlopen to Queenstown has been nine days and ten hours, and West bound about the same. These ships always run full. They have now all their passenger lists full for April, and over twenty passengers recorded for every one registered at this time last year. The new iron ship yard of the Philadelphia and Reading Railroad Company, on the Delaware here, is nearly finished, and it is reported the company will commence the construction of some thirty iron steam colliers about the 1st of April.

The depression in the iron trade has had its natural effect upon ore miners, and prices for ordinary ores rule much lower than last year. The Lake Champlain Iron Company, Withersbee, Sherman & Co., proprietors, offer in their circular of 18th ult. 50,000 tons of Old Bed ore at \$4.70 per ton, for select lump for puddling, and \$3.85 for furnace ore, on wharf at Port Henry, and 50,000 tons more, later in the season, at \$4.30 and \$4, respectively, for same ore at same delivery. This will make about \$8 to \$8.50 for puddling ore here, against \$9.50 to \$10 last year, while furnace ores will rule lower.

The northern magnetites, and all Hudson River ores, are likely, however, to meet with sharp competition from Virginia ores of greater purity and equal abundance. A company has lately been formed to mine and ship ores from the line of the James River Canal to the North, and is proceeding vigorously toward delivery of both ordinary furnace and strictly Bessemer ores. These ores you have alluded to editorially hitherto, with analyses of their valuable constituents. They will furnish a very full supply of excellent magnetites, hematites and specular ores, both for steel and iron, and as they can be delivered both earlier and later in the season than either Champlain or Lake Superior ores, and much cheaper, it is not surprising that the large consumers are contracting for them in quantity. Thus the necessities of the trade constantly increase the development of the mineral resources of our country.

Coke in Anthracite Furnaces.

A correspondent of the Reading Times and Dispatch sends the following interesting intelligence:

It is reported that a number of enterprising furnace men who have kept their furnaces in blast since the panic of 1873, who have hitherto been dependent on anthracite coal for their furnaces, now intend to use coke. This is a move in the right direction, and it is hoped that those who have shown a willingness to continue on running their works during these trying times will not be compelled to stop on account of the difficulty now pending in the anthracite coal region, since all the world knows of our immense deposits of coal beyond those of the anthracite coal fields of Eastern Pennsylvania, which cover an area of four hundred square miles, or only about one one hundred-and-fortieth of the area of the Allegheny coal fields. These coals are extensively used for making iron—more than one-half of the pig iron produced in the United States being made from anthracite coal. The small extent of these fields, and the great value placed on anthracite coal for family and other uses, have given them a wide reputation, which has induced heavy capitalists to monopolize the control of these valuable lands. Since then, the great demand for this coal has induced them to combine on fixed prices, which of late years have increased beyond the limit the iron master can afford to pay, and, as a consequence, millions of tons of bituminous coal from the Allegheny coal fields are being shipped to Eastern Pennsylvania (the great iron center) to take the place of anthracite coal, and upon which the freight alone amounts to four times the cost of the coal on board of cars at the mines. The cost of this coal, freight included, about equals the present price of anthracite coal delivered to the iron works in Eastern Pennsylvania.

In case the coke made from the bituminous coal of the Allegheny coal fields will answer as well for the furnaces which are built for the use of anthracite coal as the raw coal from the Allegheny coal fields is now answering for rolling mill purposes, it will, no doubt, be an agreeable surprise to the owners of at least two hundred and fifty furnaces who have previously depended on anthracite coal for their furnaces. The iron manufacturers of this country should carefully study the geology of the country and examine into the immense stores of billions of tons of the best coal and iron ores in the known world that are within the grasp of the furnaces of Eastern Pennsylvania before they allow themselves to be further dictated to by a few who are now threatening the extinction of the iron industry in this section.

Among the furnace men that are about to use coke in place of anthracite coal are E. & G. Brooks, of Birdsboro; G. Dawson Coleman, of Lebanon; and the Wistar Furnace, of Harrisburg.

James B. Neilson, Inventor of the Hot Blast.

Mr. Jacob Reese sends the following sketch of Neilson to the Pittsburgh Commercial:

James Beaumont Neilson was born at Sletteston, a small village near Glasgow, on the 22d of June, 1792, the same year that Robert Morris, of Philadelphia, purchased six thousand acres of the great Lehigh coal property. Neilson's parents were poor; his father never made more than sixteen shillings a week. James' education was confined to reading, writing and arithmetic, which he obtained at the parish school, and when fourteen years of age he was apprenticed to learn the trade of an engineer. When through his apprenticeship, he was employed by William Taylor, to look after his engines at the coal works of Irvine. In 1817 he was appointed foreman of the Glasgow Gas Works. While managing the gas works, he established a Workman's Institute for mutual improvement.

In 1835 Mr. James Ewing directed the attention of Neilson to a defect in one of the Muirkirk blast furnaces, situated about half a mile distant from the blowing engines, which was found not to work so well as others which were close to the engine. This was strange indeed, for one furnace was exactly like the other, and their burdens precisely the same. Neilson conceived the idea that friction retarded the passage of the blast in the long pipe, and immediately commenced experimenting in a small way at the gas works. His experiments confirmed his impression, and he then recommended Mr. Ewing to build a fire under the long pipe, because when the blast was warm it would travel faster.

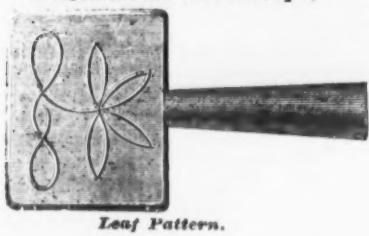
This advice the company would not take, because, they said, "the biggest dunce knows we make the best iron in winter, when the blast is coldest." This gave Neilson a new idea, and he determined to solve the problem whether the temperature of the blast had any effect to hasten or retard combustion.

After exhaustive experiments he was convinced beyond a doubt that increased temperature of the blast would produce more rapid combustion, and in 1828 he filed his application for a patent. Alone he stood battling for his invention. The wisest men laughed at him, because the best blast furnaces in Scotland used ice to cool their blast in summer. At length, however, Mr. Colin Dunlop allowed Neilson to make a trial of his hot blast at the Clyde Iron Works, in return for which Neilson gave Dunlop and his associates seven-tenths of the patent. The trial was successful, and as it made quite a stir, the patents were reassured with improvements in 1831.

What an eventful life! How profitable to mankind! He served his apprenticeship and learned to work, and by careful study learned to think, and reason from effect to cause. With brain and muscle he walked the path, practically demonstrating each hypothetical deduction, from fact to fact, until he perfected his great invention. How many thousand brighter minds have theorized all their lives without profitable reward? Experimental education is what we want, and that is the design of the State in establishing the Mechanics' High School, of Pennsylvania.

H. D. SMITH & CO., PLANTSVILLE, CONN.

Patent Embossed Steps.



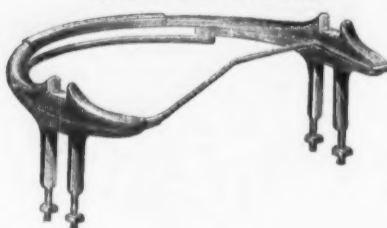
Leaf Pattern.

King Bolt Yokes.



Established 1850.

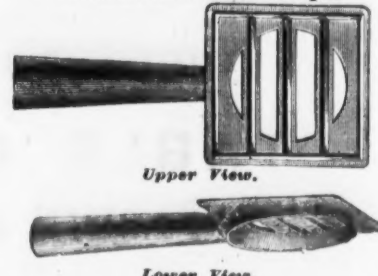
No. 6 Fifth Wheels.



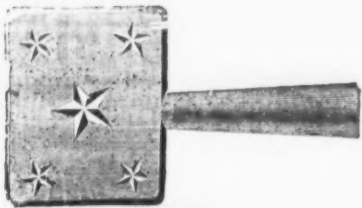
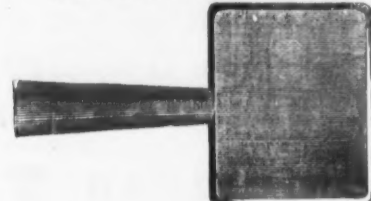
1871 Pattern Shaft Couplings.



Patent Cross Bar Steps.



Solid Plain Pattern Steps.



Star Pattern.

Smith's Improved Philadelphia Pattern Slat Irons.



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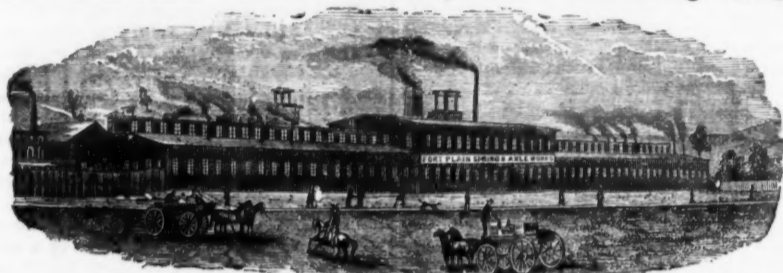
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Green Jacket Axles, FORT PLAIN, N. Y. Fine Carriage Springs.



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COLLAR to the FINEST OF STEEL.

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inery, we defy competition.

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Best Bolt manufactured for all kinds of agricultural machinery. Will not split the wood, and can not
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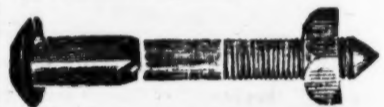


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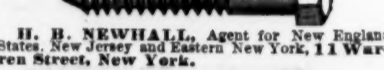
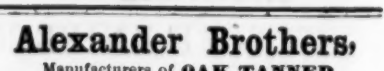
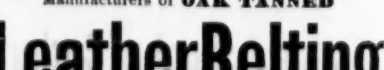
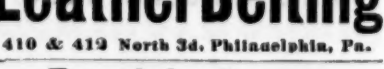
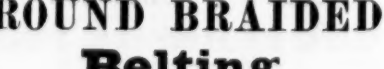
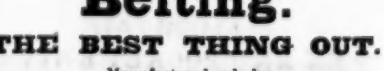
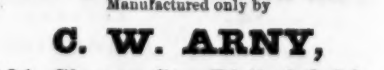
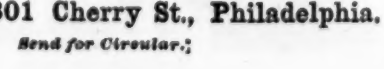
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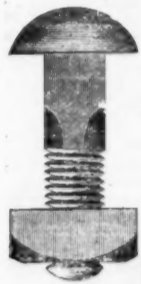
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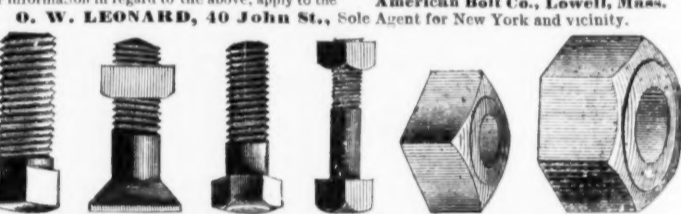
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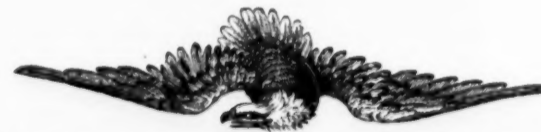
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The Iron Age.

New York, Thursday, March 11, 1875.

DAVID WILLIAMS - Publisher and Proprietor.

JAMES C. BAYLES - Editor.

JOHN S. KING - Business Manager.

New York, January 2, 1875.

Until the 1st instant the postage on newspapers was paid by subscribers at the office where the paper was received, the yearly rates on the different editions of *The Iron Age* being as follows: Weekly, 40 cents; Semi-Monthly, 40 cents; Monthly, 24 cents. Under the provisions of the new postal law, which went into effect on the 1st instant, prepayment at the office of mailing is required, at the rate of two cents per pound for the Weekly, and three cents per pound for the Semi-Monthly and Monthly, which will make the postage as follows on the different editions: Weekly, 50 cents; Semi-Monthly, 30 cents; Monthly, 15 cents.

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City Subscribers will confer a favor upon the Publisher, by reporting at this office any delinquency on the part of carriers in delivering *The Iron Age*; also, the loss of any papers for which the carriers are responsible. Our carriers are instructed to deliver papers only to persons authorized to receive them, and not to throw them in hall ways or upon stairs; and it is our desire and intention to enforce this rule in every instance.

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The Business Outlook.

During the past few weeks there have been many indications which, in the absence of any definite assurances concerning the future, warrant the hope that we are about to witness the beginning of a healthy and sustained recovery of general business from the long protracted inactivity which succeeded the prostrating effects of the panic. How far this will go toward insuring us an average spring trade remains to be seen, but the opinion is generally entertained in well informed business circles that we have passed the turning point, and that everything is steadily tending in the direction of a return of general industrial and commercial activity. The facts upon which this opinion is based may be

briefly stated as follows: Stocks in retailers' hands are unusually small; the wants of consumers, which are large in proportion to the economy of consumption which has been observed by all classes of the community since the fall of 1873, must be supplied or, more properly, anticipated by the purchase of large and well selected stocks of manufactured goods of all kinds for the retail trade. There is no tendency toward speculative activity. During the past year and a half there has been a steady progress in liquidation, and it is probable that the amount of indebtedness between retailers, jobbers and manufacturers is smaller now than at any time for several years. Whatever business is done this spring is very sure to be done upon a safe basis, for confidence is not yet so fully restored that any class of producers or distributors will risk any bold ventures. Certainly there is little danger of overtrading this spring. Prices are now very nearly down to gold figures, and wages have declined, with but little prospect of soon advancing to the high rates paid since the war. We have not discovered any disposition on the part of buyers in any of the principal markets to delay purchases on account of any uncertainty as to the future of prices, nor any anxiety on the part of manufacturers or dealers to press sales on that account. The jobbers in cities from which the supplies of retailers in the agricultural districts are chiefly drawn are buying with about as much freedom as in times of general prosperity, and with the advance of the season we may expect to witness the development of a spring trade which, if it does not realize all the expectations which have been formed, will at least prove satisfactory to the majority of tradesmen.

As to the iron market, there is little to warrant the belief that it will share in any marked degree the immediate benefits of an improvement in general trade. An advance in the price of pig iron great enough to appreciably benefit makers would probably lead to the blowing in of furnaces enough to over supply the market, and force prices down again to, or below, the cost of production. The long hoped for improvement in this trade will be brought about gradually. With a renewal of activity in general manufactures we shall have an increased consumption of manufactured iron in all forms, but the demand of the railroads, to meet which our iron industries were expanded to so great an extent during the ten years ended with 1873, will be limited for a considerable time to come. Legislative tampering with questions connected with transportation—particularly with railway management and railway tariffs—has rendered capital timid. It will not risk investment in enterprises which, when completed, can be made subject to "Potter laws," or enactments of like character and purpose. Capitalists will not build railroads which are to be managed, when completed, by the hayseed statesmen of the Granges who control legislation in so many of the Western States, or by convention orators and office seeking demagogues who form the rank and file of the "cheap transportation associations" in States where Granges are powerless. There is, moreover, considerable uncertainty as to what the national government may attempt or accomplish in the exercise of the power which has been claimed for it under Art. 3 Sec. 8 of the Constitution, and so long as this uncertainty exists so long will our progress in railroad building be less rapid and general than it would be were capital assured of immunity from legislative interference. In the course of an address lately delivered by the Marquis of Salisbury before the Manchester Chamber of Commerce, the philosophy of this whole question was so clearly and concisely stated that we cannot do better than quote the language of the eminent British Statesman: "Capital will go, as we well know, to any part of the world. It will face any difficulties and dangers in seeking employment. But there is one thing which frightens it back, and that is any great uncertainty as to the conditions under which it is to be employed. If it knows the worst, it can adapt itself to the worst; but if there is the probability of some great change of uncertain scope and import, upon which some attach a large importance, and some a small importance, the calculations become altogether so uncertain that no man of capital likes to risk his money in the venture." This is an elementary truth which those who make laws for the regulation of railroads would do well to remember.

Marine Disasters in 1874.

The Bureau Veritas, in its annual report of losses at sea in 1874, places the total number of sailing vessels and steamers lost during that year at 2268. The number of sailing vessels was 2093, representing the merchant fleets of every maritime nation.

The following is a comparison of the losses of sailing vessels for a number of years:

	No. vessels.
During 1874.....	2,093
During 1873.....	2,165
During 1872.....	2,692
During 1871.....	2,426
During 1870.....	2,313
During 1869.....	2,453

There is a curious coincidence in the uniformity of the totals for the years given. The annual average for the five years is 2355, and from this the number varies but little either way in any year. The total for 1872 is the largest of any, and when we take into account the increased number of vessels afloat, it will appear that the percentage of loss is diminishing. But it is still alarming to think how great a fleet goes to the bottom or is broken up on shore every year.

Of steamers, the following totals of losses are given: 1870, 179; 1871, 175; 1872, 244; 1873, 187; 1874, 175. All the maritime powers, great and small, are represented in the list. Great Britain is proportionately a heavier loser than any other nation. Her "cheap ships," which so many Americans have manifested a desire to buy, and with which we were promised the restoration of our merchant marine, are, as the rule, less seaworthy in proportion to their number and tonnage afloat than those of any other nation. The percentage of British iron steamers annually lost is very large, and the revelations made by Mr. Plimsol, M. P., not long ago, show that British ship owners are not more scrupulous than British ship builders. We can and do build better ships in this country than are built in England, especially iron ships, and experience is showing that, all things considered, they are as much cheaper as they are better, even though the first cost is somewhat greater.

Iron Ores for the Centennial Exhibition.

We print on another page of this issue a circular letter signed by Hon. Daniel J. Morrell, Chairman of the Committee of the American Iron and Steel Association having in charge the work of collecting iron ores for exhibition at the Centennial, in which is set forth the plan of operations agreed upon for the furtherance of the work. This is simply the solicitation of voluntary contributions of money and samples of ores, and those who make such contributions are assured that they will thus be relieved of all trouble concerning the proper exhibition of the ores and fuels in which they are interested. When the Committee know what support they can expect in the matter of voluntary contributions, they will mature some plan by which they hope to insure the success of the work.

With all respect for Mr. Morrell and his associates, we think this is little better than trifling with a subject which has been trifled with too long already. Were they to receive all the assistance and co-operation which the most sanguine of them could expect, they would not have time to complete the work they have undertaken in a manner which would be at all satisfactory to themselves or the public. In the year which remains, the work can only be done satisfactorily and thoroughly by the several States, and we would earnestly advise the committee of the Iron and Steel Association to bend every energy to induce the State governments to appoint commissioners to collect, analyze, and classify ores and forward such collections to Philadelphia where, the Iron and Steel Association can take charge of them. We have no time for any more unsuccessful experiments of any kind, and the plan of voluntary contributions adopted by the committee cannot, we think, possibly succeed. If we are to have an exhibition of ores at the Centennial that shall be any respect national, or from which a correct and comprehensive idea of the coal and iron resources of the country can be obtained, each State must do the work for itself. If such co-operation cannot be secured, the project might as well be abandoned now as later. To prepare the ores for exhibition after they are collected, condense the various reports which would be sent in with them, and direct the preparation of the maps and charts which will be needed to show the geographical distribution of ores and coals over the whole country, will be quite as much as the committee of the Iron and Steel Association need care to undertake.

The Anthracite Coal Troubles.

The strike of the Schuylkill miners is occasioning serious inconvenience to the furnaces which have continued in blast in the hope of a return of general industrial activity and a better demand for iron. A considerable number of those which have continued blowing up to the present time will have to blow out, unless the experiment of using Western coke should prove successful. As will be seen from statements made in other

columns of this issue, several of the furnaces are using coke in admixture with anthracite. A correspondent informs us that the superintendent of the Pennsylvania Steel Company's furnaces is now using one quarter coke, until certain alterations in the machinery operating the hoists can be made, by which they can be worked with a reduced blast, when he will use one-half coke, or all coke, if necessary. The coke is delivered on cars in Westmoreland county at 3 cents per bushel or \$1.50 per net ton. The freight to Harrisburg and adjacent points is \$2.60 per ton, making the cost at furnace \$4.10 per ton. The cost to furnaces on the Schuylkill is about \$5. The experiment has not yet been tried long enough, or under conditions sufficiently favorable to determine the comparative economy of anthracite and coke, or the effect of substituting the one for the other in an anthracite stack will have upon the character of the iron made. When this has been determined we hope to acquaint our readers with the result. There is some doubt expressed by practical men whether the shape of anthracite furnaces will admit of the use of coke with advantage. The successful coke furnaces are so constructed as to accommodate the rapid expansion of the fuel which takes place as soon as it becomes hot. The gradual downward enlargement of the anthracite stacks may not allow this expansion to take place. Whether this is so or not, must be determined by practical tests.

For furnaces which are not prepared to try this experiment, and which have no stocks of coal on hand, there seems to be but one alternative. The Philadelphia and Reading Coal Company lately gave notice to the furnace owners along the line of the Reading Road that their stock of coal at Port Richmond, of which large quantities had been sent back over the road almost to the mines, was so nearly exhausted that it would not last much longer, and it now has not a ton of furnace coal on hand. When the strike began they had in stock 10,000 tons lump, 15,000 tons steam coal, and 20,000 tons of smaller sizes, all of which has been sold for consumption, together with 5000 tons, or more, of Wyoming Valley coal. Supplies from this source are now cut off, owing to the successful efforts of the Schuylkill miners to secure the co-operation of those in the Wyoming Valley, and those dependent upon the Reading Company for coal must do without it for the present. The furnaces along the Lehigh and Upper Susquehanna are supplied from the Wyoming mines, but the operators, who have the miners under present control, are directing their efforts to the accumulation of a surplus stock, and will not allow any considerable amount to be diverted to other sections. At last advices there was no prospect of a settlement being reached by compromise, and neither side is ready to yield the contest and meet the other's terms.

The Statistical Position of Tin.

In an article published in our issue of January 28th, we gave the statistical position of tin in Europe at the close of last year, and are now able to compare it with the statistics of February 1:

THE VISIBLE SUPPLY OF TIN.									
	1874.	1873.	1872.	1871.	1870.	1869.	1868.	1867.	1866.
Dec. 31.	31.	31.	31.	31.	31.	31.	31.	31.	31.
Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Stock of foreign tin in London.....	2,897	1,954	956	3,362	2,336	788			
Banca tin in Holland.....	508	634	1,111	1,015	1,070	886			
Banca tin in company's hands.....	3,888	3,708	2,146	3,246	3,298	2,609			
Britain in Holland.....	1,019	829	479	982	847	940			
Afloat for Europe.....	4,157	2,361	2,345	1,900	1,450	2,000			
Total.....	12,494	9,486	7,937	11,145	9,001	6,520			
Price.....	£24.		£21.10	£115.	£146.				

From this it will be seen that the total amount afloat had been reduced from 4157 tons on the 1st of January to 1950 tons four weeks later, resulting in a difference of 2207 tons. There being a good consumptive demand, the heavy arrivals of Straits tin did not swell the stock of foreign tin in London to the extent that would otherwise have been the case, the increase being but 1055 tons. The total stock in Holland was diminished but 187 tons, declining from 5380 to 5243. Deducting, therefore, from the 2207 tons less afloat the London excess of stock of 1055 tons, less the Dutch decrease of 187 tons, and it will be found that the visible supply had been reduced 1289 tons, being but 11,145 tons on Feb. 1, against 12,494 January 1.

In spite of this improved aspect, the price of Straits tin declined from £24 to £21.10, and subsequently to \$88, thence to recover to £20, which improvement was lost again subsequently.

Although the position of tin was temporarily strengthened by disturbances in the Malay Peninsula, the rapidly increasing Australian production at a time when the metal trade of Europe and America suffered from general prostration was too

much for it, and although in spite of the stagnation 27,000 tons were consumed in 1874, two years sufficed to bring down the value of one of the leading metals from £146 to £88, or about 40 per cent.

Australian production being the main disturber of the value of tin, it should be noted that its production in 1872 was but 150 tons; in 1873, 2990 tons, and in 1874, 5800 tons. The chief interest consequently centers on reliable news from that quarter.

Toward the latter part of last year Australian production seems to have taken a fresh start, to judge from what we translated under date of February 4, from the *Moniteur des Interets Materiels* of January 17. The Paris metal review expressed itself, it will be found, to the following effect:

Accounts are to hand from both Sydney and Brisbane (Australia), which are not calculated to make holders of tin feel over-confident in the maintenance of ruling rates. At Sydney during the four weeks ending November 7, upward of 732 tons had been sent from the mines, a considerable increase over previous receipts, and in Queensland, according to Brisbane accounts dated November 16, some 470 tons had been received in October, an excess of 20 tons for the month. What may not be expected in the way of an increase in the Australian production for the current year, if the progress thus far made there be kept up in the same ratio? This news has had a flattening effect upon the European tin market, and will, in all likelihood, also be unfavorably reflected at the Dutch sale of 23,000 slabs, to come off on the 27th inst., at Rotterdam. The tendency at London has been a downward one, carrying Straits from £28 to £24, since when a faint rally has been perceptible.

France being next to England the largest actual consumer of the metal, and most of her manufactures drawing their supplies either from Paris, or its port, Havre, or availing of Paris credits in order to procure it from Holland, the metal papers of the capital watch the shifting aspects of the tin supply quite as closely and intelligently as is the case in either England or Holland. The Dutch sale alluded to by the *Moniteur* at the time, taking place ten days subsequently, proved, indeed, quite a failure as regards the average value realized, and gave the signal for a heavy decline, from all appearances not yet arrested.

Turning, then, to the latest general accounts from Australia, to hand by last week's mail from London, we find the following letter, dated Sydney, Dec. 26, 1874:

"The monthly returns of Australian tin production should satisfy those interested that it is not falling off, and the sooner the fact is recognized that it is impossible for the Cornish tin mines to successfully compete with us in the cost of production, the better it will be for all parties concerned. A fall of some £45 per ton in the price of tin has not decreased our yield, nor would that effect be produced by a further reduction to a rate that would prevent any tin mine in Cornwall from being worked to profit. Unless there is such an increase in the consumption, as will absorb the extra produce, the poorer mines must give up. Your (English) tin miners appear to be much dissatisfied with the prices given for ore by the smelters, and in this feeling we can, as fellow sufferers heartily sympathize with them. But why do they not follow our example, and smelt their own ore? If one mine does not raise sufficient to make this operation profitable, let a few mines combine to erect smelting works on their joint account. The price now paid for smelting in New South Wales is about £5 per ton of ore, and the loss sustained is from 2 to 2½ per cent. of the amount of tin in the ore, as indicated by an exact assay. For instance, the two last parcels of ore smelted for me gave respectively 72½ and 73 per cent. of tin. Here the smelting business has been rather overdone; to keep their furnaces in work, the smelters have to purchase ores at a fair price, and tin ore is now selling at about the same price in Sydney that it is bringing in London. Perhaps some of you on your side would, in return for the results of our experience, inform us why Australian tin, which is not inferior to any in the market, brings the lowest price. That it is equal in quality to the best English brands we know from comparative chemical analyses and other tests, and yet it is quoted in London at from £5 to £7 per ton less. The tin shipped from here direct to America is reported as equal to the best English. Is there any truth in the rumor that after the Australian tin reaches England a considerable proportion of it is passed to the melting-pot, recast, and then comes out as 'English refined'?"

The foregoing confirms the opinion which has been current at New York for some time past, that Australian tin ore is not only in abundant and rapidly increasing supply, but that the ore itself is very rich. In order not to be at the mercy of smelting works, co-operative smelting is resorted to by a number of smaller Australian mines. The suspicion that English smelters, to some extent, re-cast Australian and stamp it "English Refined," may not be altogether unfounded. That the little Australian tin brought here by wool vessels that took it for better stowage, was found to be of excellent quality, has been admitted. In our report dated Oct. 8th, 1874, we expressed ourselves as follows: "Some odd lots of Australian arrived at this port quite recently. We should get plenty of it direct but for the dull trade in wool of late between Australia and this coast. With the revival of this traffic we may get a goodly share of Australian tin for good stowage or trim of the clipper bound thence to New York and Boston. It is, in fact, but a matter of time, and we shall commence in good earnest to draw tin from Australia, the great tin producing country of the future."

In 1873-'74 the shipments of wool direct from Australia to New York and

Boston amounted to but 9000 bales; this year we shall get 25,000 bales, and the increasing traffic in that article may start a direct tin trade. The Australians have since begun to imitate, in weight and shape, Straits slabs. We do not see why both the Australian producer and American importer or consumer should not strive to establish direct relations, rather than permit recast tin of Australian yield to be palmed off upon us for English refined at a higher price. But however this may be, the immediate and remoter future of tin values is shrouded in uncertainty as much as ever, even at the great reduction effected by the causes we have endeavored to elucidate. Recent letters from London express the apprehension that a further considerable drop may be impending, unless consumption continues to develop as healthily as it did during the, in other respects, rather dull month of January. The statistics of March 1, which will soon be at hand, will possibly enable us to form some judgment in this respect. The rapidity with which Straits tin reaches London by steamer *via* the Isthmus of Suez, has, we may add, disconcerted European statisticians not a little.

Ores for the Centennial.

Our readers have already been informed that the American Iron and Steel Association, having failed to carry out its original plan for the collection and classification of iron ores for the Centennial Exhibition, have adopted a new plan, which is set forth in the following circular letter:

Office of the American Iron and Steel Association, No. 265 South Fourth Street, Philadelphia, Jan. 28, 1875.

SIR: In October, 1874, the Centennial Commission referred the task of making a collection of iron ores, fuels, fluxes and refractory materials to the American Iron and Steel Association, as the national representative of the iron trade of the country. The commission suggested that "a fund be raised by private subscription to defray the inevitable expense of the collection of ores, and placed in the hands of the Treasurer of the American Iron and Steel Association." The association accepted this trust, and last year organized a scientific board to hold its meetings in Philadelphia and act in connection with the officers of the association. This plan was, however, abandoned, owing in part to the extreme depression of the iron business, and in part to doubts whether, after the refusal of Congress to make an appropriation in its behalf, there would be an exhibition. The association has now taken action in the direction of seeking the aid and co-operation of its own members, both to contribute a sufficient sum to defray the cost of gathering and exhibiting a proper collection of the iron ores of the entire country, and to lend all convenient assistance in contributing specimens from their own mines. In accordance with this plan, the association, at the meeting held in Philadelphia, February 11th, 1875, adopted the following resolution:

"Resolved, That the president appoint a committee of seven members of the association whose duty it shall be to take such measures as may be necessary to secure a proper display at the Centennial Exhibition of iron ores, fuels, and iron and steel products, the said committee to have the power to collect funds and to employ suitable expert assistants."

The President appointed the following gentlemen to act as said committee:

DANIEL J. MORRELL, Johnstown, Pa.
W. E. COX, Reading, Pa.
ANDREW CARNEGIE, New York.
JOSEPH WATSON, Philadelphia.
WM. FIRMSTONE, Easton, Pa.
JAMES I. BENNETT, Pittsburgh, Pa.
FATETTE BROWN, Cleveland, Ohio.

The committee has held one meeting, at which it was resolved to take immediate steps to carry into effect the object for which it was appointed. At this meeting the active co-operation of Mr. J. B. Pearce, of Philadelphia, Mr. Galloway C. Morris, of Philadelphia, Mr. Z. S. Durfee, of New York, and others, was promised. Arrangements were made to begin work at the earliest practicable moment.

Having therefore organized and begun work, the Committee appeals to all persons in the trade throughout the whole country, whether members of the Association or not, to support it liberally in the task of making a connected, useful, and creditable exhibition of the iron resources of the country. The sum of \$15,000 is estimated to be the least that will defray the inevitable office and storage expenses, the expense of construction of cases and arranging collections on the most economical scale, etc. Parties contributing money and collections will thus relieve themselves of all trouble concerning the proper exhibition of their ores and fuels, and at the same time aid in securing the success of the Exhibition. It is desirable that all parties or firms who intend to exhibit shall at once communicate with the Chairman of the Committee. When we ascertain the support we are likely to receive, and the sections from which it is drawn, we can announce a definite plan and request attention to proper specifications in regard to the character of the collections to be forwarded.

We have in this country a boundless wealth of iron ore and coal, and every owner and manufacturer is equally interested in gaining a correct idea of the comparative character of the deposits of all sections, and in convincing foreigners and our own citizens of the value of particular localities. The interests furthered by such an exhibition are vital and take the widest range. In the home manufacture, the question of transportation will be exemplified by full exhibits of the ores of given regions, with data concerning their shipment, and interesting facts will be brought out concerning the quality of the products made from them. It cannot be expected that another opportunity will occur in this generation at all comparable to this for inviting the attention of foreign capitalists, or of those desiring to increase their ore supply, nor for impressing upon our fellow citizens who are not interested in iron the immense importance of this industry and the consequent necessity of promoting its welfare by wise legislation. Let every one respond promptly, according to his ability, and we will show, as has never yet been shown, how large and vital is the interest we represent. Now is the time, and it will be no excuse to say that credits of any kind prevented any one from timely action. The success of the Exhibition is now certain, the buildings are well under way, and the first great national opportunity is now offered to the iron trade of America to prove its greatness and its energy.

Checks should be drawn payable to the order of Charles Wheeler, treasurer.

All letters should be addressed to me, until further notice at the office of the American Iron and Steel Association.
By order of the Executive Committee.
DANIEL J. MORRELL, Chairman.

The following correspondence between Mr. J. Blodget Britton and Mr. James M. Swank, of which Mr. Britton has favored us with a copy, will serve to explain why the scientific commission, appointed in January, 1874, never did anything and, indeed, never met for organization. We print the correspondence as an act of justice to Mr. Britton and the gentlemen who were invited with him to serve upon the commission:

THE IRON MASTERS' LABORATORY,
No. 339 WALNUT STREET,
PHILADELPHIA, Jan. 21, 1875.

JAS. M. SWANK, Esq., Sec'y Am. I. & S. Ass.—DEAR SIR: About a year ago I accepted an appointment upon the scientific board suggested by your association for the collection, classification, and exposition of American iron ore at the Centennial Exhibition, proposed by me, Dec. 3, 1872, to the Hon. Daniel J. Morrell. What has your association since done in the matter, and what does it propose to do? Will you please inform me? J. BLODGET BRITTON.

OFFICE OF THE AMERICAN IRON AND STEEL ASSOCIATION, No. 265 SOUTH FOURTH STREET, PHILADELPHIA, Jan. 28, 1875.

DEAR SIR:—I have been unusually busy this day, or would have called to see you about the ores.

We could do nothing a year ago, because, first, we received no money from any source to help us to bear expenses of collecting and analyzing ores, and, second, because for a long time it seemed to be uncertain whether, in consequence of the failure of Congress to make the appropriation of \$5,000,000, we would have an exhibition.

The whole subject comes up at our annual meeting, Feb. 11. I think the present determination is to ask for ores and analyses to be sent to Philadelphia. We have no money to pay for analyses. Truly and hastily,
JAS. M. SWANK.

THE IRON MASTERS' LABORATORY, No. 339 WALNUT STREET, PHILADELPHIA, Jan. 21, 1875.

JAS. M. SWANK, Esq.—DEAR SIR: Please accept my thanks for your prompt reply to-day.

I learn from it for the first time that your association has not acted in the matter, that you "think the present determination is to ask for ores and analyses to be sent to Philadelphia, and that the association is without means to defray the necessary expenses of the work proposed in your letter of December 24th, 1873. I therefore conclude that the services of the Scientific Commission will not be required, and a meeting of it will not be called. Am I correct? As a member of the Commission I wish to feel relieved from any responsibility.

Respectfully, yours, J. BLODGET BRITTON.

OFFICE OF THE AMERICAN IRON AND STEEL ASSOCIATION, No. 265 SOUTH FOURTH STREET, PHILADELPHIA, Jan. 28, 1875.

J. BLODGET BRITTON, Esq., Philadelphia.—DEAR SIR: In reply to your letter received last evening I beg to say that our annual meeting will be held on the 11th of February, at which time the question of collecting ores for the Centennial will be either provided for or disposed of. Pending the decision of the association I would not like to take any steps that might lead to a dissolution of the scientific commission, and therefore pray you to reserve your withdrawal until after the determination of the meeting shall be announced. I am yours, very respy,
JAMES M. SWANK, Sec'y.

THE IRON MASTERS' LABORATORY, No. 339 WALNUT STREET, PHILADELPHIA, Jan. 23, 1875.

JAS. M. SWANK, Esq.—Sec'y Am. I. & S. Ass.—DEAR SIR: Please accept my further thanks for your reply of this date. The failure to secure a display, as was contemplated and most strenuously urged, of American iron ores at the Centennial Exhibition, I regret exceedingly; and every true American will regret it. It may with truth be charged mainly to the course taken by those having charge of the matter authoritatively. A great national work has been defeated, and a material public loss will result. Blame will unquestionably attach somewhere. Some of it may be unjustly cast upon the Scientific Board, whose aid, as was publicly announced, your association requested. As a meeting of that Board was never called, and nothing whatever entrusted to it, its members should not suffer. I believe that in justice to each of the gentlemen a meeting should be called at once, by direction of the Executive Committee of your association, and the facts that you have stated to me be communicated to all, and an opportunity given for such united action as may be thought proper. Perhaps something of importance may yet be devised at this eleventh hour, if the Board be allowed to speak at all. I, as a member of that Board, most respectfully beg that such a meeting be called, and notice to distant members be sent by telegraph. Not a moment should be lost.

Yours, truly,
With great respect,
J. BLODGET BRITTON.

THE IRON MASTERS' LABORATORY, No. 339 WALNUT STREET, PHILADELPHIA, Jan. 28th, 1875.

My DEAR SIR: Understanding from your conversation yesterday that a meeting of the Scientific Board will not now be called, and that it is proposed on the part of your association to hereafter announce its inability to accomplish what it undertook to do, and simply request that ores, &c., with reports of analysis, be sent to the exposition at the sender's expense, I cannot upon reflection see how the board can give any aid whatever in the matter. I therefore beg you to accede to my request, and accept my resignation. Thanking the Executive Committee sincerely for the honor of the appointment, I am very truly yours,
J. BLODGET BRITTON.

To JAS. M. SWANK, Esq., Sec'y Am. I. & S. Ass.

OFFICE OF THE AMERICAN IRON AND STEEL ASSOCIATION, No. 265 SOUTH FOURTH STREET, PHILADELPHIA, Jan. 28, 1875.

J. BLODGET BRITTON, Esq.—DEAR SIR: I think that I have at no time stated what would be the action of our association, but only what I supposed it would be. There is a great difference, you see. Wait until the 11th of February, when the whole matter will be decided officially.

Hastily yours,
JAS. M. SWANK, Sec'y.

THE IRON MASTERS' LABORATORY, No. 339 WALNUT STREET, PHILADELPHIA, Jan. 29, 1875.

J. M. SWANK, Esq.—DEAR SIR: My resignation was sent because I believed that any aid from the board would not be required, and I wished to be relieved from all responsibility. But if

* This refers to the original proposition in the letter laid before the United States Centennial Commission, at the general meeting held at the Centennial Hotel, in Philadelphia, December 3, 1872.

my services can avail hereafter, be assured that they will be given most cheerfully and promptly.
Yours, very truly,
J. BLODGET BRITTON.

The Law of Patents.

(Continued.)

DECEASED INVENTORS, TITLE TO THEIR IMPROVEMENTS.

A patent granted to the administrator of an inventor is held by him *prima facie*, in trust for the heirs; and they must be made parties to a suit in equity on the patent so long as they retain such an interest.

But if the inventor had sold his interest prior to his decease, the assignee must be made the party, and not the heirs.

[N. W. Fire Extinguisher Co. et al. vs. Philadelphia Fire Extinguisher Co., 31.

FOREIGN PATENTS.

The validity of a patent is not impaired because the invention is embraced in a prior English patent, if, previous to the date of the latter, the American patentee had reduced the invention to practice.

[The National Spring Co. vs. The Union Car Spring Manufacturing Co., 224.

An English provisional specification is a bar to a patent only as a printed specification describing the invention. The patent constitutes no objection.

In order to be an effectual bar, the description must be so full as to leave no doubt as to the identity of the device.

[Cohn vs. The U. S. Corset Co., 259.

It is incumbent on the defendant in such a case to make out the sufficiency of the description.

The patentee's invention consisted in weaving corsets with pockets of varying lengths, so as to hold bones fitted to the contour of the body. A prior provisional specification described the weaving of corsets in which the pockets were made of "any required length," and which, when completed, would "contain all the elegance and graceful contour of corsets made by manual labor;" and, it appearing that hand sewed corsets were well known at the time, with pockets adapted to the form, the provisional specification was held a bar to the patent.

[Cohn vs. The U. S. Corset Co., 259.

FUNCTIONAL CLAIMS.

1. A claim for an effect or function cannot be sustained; the means by which the effect is produced, or the function performed, must be specified.

[Wheeler et al. vs. Simpson et al., 435.

INFRINGEMENTS.

Letter blocks with pictures upon some of their faces do not infringe upon a patent for such blocks with figures upon some of their faces, by which they can be selected in accordance with a key accompanying them, so as to spell particular words, such blocks with pictures having been long known.

[Hill vs. Haughton, 3.

If the combustion chamber of a furnace for burning wet fuel is constructed in other respects precisely as specified in the first and third claims of a patent it constitutes an infringement, although it has a flat inclined bottom and a wide throat instead of a *cyma reversa* bottom and a narrow throat, as described in the patent, and specified in other claims, but not in the first and third.

[Bantz vs. Elsas et al., 117.

A stone breaking machine in which the movable jaw is actuated by a hydraulic press operating through a piston rod, is an infringement of a patent for a similar machine in which the movable jaw is actuated by a pair of toggle levers, operated by a lever and crank rod; although in the former a safety valve is provided for relieving the pressure when such resistance is encountered as to endanger the breaking of the mechanism.

[Blake vs. Robertson et al., 297.

If a patent describes the invention as embodied in a cheap and rude form, this will not relieve those who construct the machine with more expensive fixtures from the charge of infringement, however useful they may be.

[Brown vs. Guild; Brown vs. Selby et al., 392.

A patent for a saw, claiming, in combination, clearing teeth hollowed out in front so as to plane out the wood between the scores cut by the beam teeth is not infringed by a saw in which the wood is rasped out by clearing teeth which are straight and perpendicular in front.

A saw having its beam teeth of the usual triangular form, with intervals between them, operates by means of a construction so unlike that of a saw having its beam teeth arranged in pairs, with only a perpendicular slit between them, that it is no infringement of a patent for the latter, though the effect may be the same.

[Wheeler et al. vs. Simpson et al., 435.

Making and selling egg beaters having two beaters rotating on axes separate and apart from each other, is no infringement of a patent for such an implement having two beaters rotating on the same axis, although in both cases the beaters revolve in opposite directions.

[Monroe vs. The Dover Stamping Co., 685.

In a hand mirror, containing a wooden back with an extension for a handle, strengthened by metal rods, the whole being covered with a composition, to which form is given, while plastic in a mold, the novelty consists in the introduction of a wooden back and strengthened handle.

A patent for such a mirror is not infringed by one in which the back and handle are formed entirely of composition, though the handle is strengthened at its weakest part by nails imbedded in it.

[The Florence Manufacturing Company vs. The Boston Dialect Co., 728.

Making the lower roll in a fluting machine adjustable is an infringement of a patent for making the upper roll adjustable by similar means, and for the same purposes.

Making the roll adjustable by means of a rack and pinion instead of a screw is also an infringement.

[Knox et al. vs. Lowrey et al., 802.

INJUNCTIONS.

If the complainant's patent has been sustained in a suit, to the defence of which the defendants contributed, he is entitled to a provisional injunction against them, although they allege in their answer that they have a witness to the prior use of the invention who was not examined on the former trial.

The alleged testimony of such a witness will not prevent the issue of the provisional injunction, whatever may be its effect on the final hearing.

[Birdsell vs. The Hagerstown Agricultural Implement Manufacturing Co., 604.

INVENTION AND SKILL.

A patent for a fruit jar claimed, in combination, an outside shoulder below the top for holding the gasket, a cap with a rim pressing on the gasket, and a screw ring engaging with threads below the shoulder for holding the cover down; and it disclaimed a gasket which was pressed down upon a similar shoulder by means of a clamp, as well as a similar screw ring for holding a gasket on the top of the jar. Doubtful whether there was the exercise of any thing more than sound judgment in substituting the screw ring for the clamp in one case, or the gasket on the shoulder for the one on the top in the other.

[The Consolidated Fruit Jar Co. vs. Wright, 327.

A peg, or stop, to prevent the rear part of a machine from tipping so far as to dump the driver on the ground, is too frivolous a device to be regarded as an invention, and a patent for it is void.

[Brown vs. Hatch, 392; Brown vs. Selby et al., 392.

There is no invention in reducing an article of bulk to minute fragments, when it is not improved by adding some new ingredient, or by subtracting one or more.

[The Milligan & Higgins Glue Co. vs. Upton, 837.

JUDGMENTS AND DECREES.

The decree of a court of probate appointing an administrator can only be impeached in a direct proceeding for that purpose before a tribunal which has jurisdiction over the matter; not in an action upon a patent granted to him as the representative of the inventor.

[N. W. Fire Extinguisher Co. et al. vs. Phila. Fire Extinguisher Co., 34.

No circuit court is bound to follow the decisions of the courts of other circuits.

Nevertheless, where a patent has been sustained in the circuit courts of four different circuits, and no appeal from the decision has been taken in either case, a strong presumption arises that the parties were satisfied with the soundness of the decisions; and it is incumbent on the party who seeks to bring another court to a different conclusion to point out indisputable grounds for it.

[Blake vs. Robertson et al., 297.

The party who is defeated upon interference in the Patent Office is not prevented by the decision, nor by the patent issued upon it to the adverse party, from contesting the question of priority anew in a suit at law.

[Union Paper Bag Machine Co. vs. Crane et al., 801.

An unpublished description of an invention is no bar to a subsequent discoverer's obtaining a patent.

Neither is a rejected application for a patent by itself.

A rejected application may be received in evidence to establish prior invention in connection with evidence of the construction of a working machine embodying the invention, and successful experiments with it performed in public.

Such experiments, when they demonstrate the merits of the invention, cannot be regarded as abandoned, although they were not resumed, nor can another inventor have a patent for it afterward.

They cannot be so regarded, especially if the first inventor's application for a patent had been repeatedly and finally rejected by the Patent Office, and his circumstances were straitened.

[N. W. Fire Extinguisher Co. et al. vs. Phila. Fire Extinguisher Co., 34.

The plaintiff's patent was for a refrigerator, and the first claim—the only one adjudicated upon—embraced, in substance, a reservoir for holding the ice, and a flue, or conduit, descending from it and carrying down the cooled air and discharging it through apertures into the body of the apparatus, whence it rises and enters the ice box again, through apertures in the top of it, thus creating a constant circulation.

The patent was sustained, although another party had filed an application in the Patent Office describing a similar apparatus, but had been rejected, and had withdrawn his application long before that of the plaintiff's was filed. It was sustained, also, although a third person had purchased of the rejected applicant his invention, and had obtained a patent for it, as his assignee, after the patent in suit was granted.

[The Lyman Ventilating and Refrigerator Co. vs. Lator, 643.

If an alleged invention proves superior to what has been known before, it is evidence in favor of its novelty.

[Birdsell vs. McDonald et al., 682; Birdsell vs. The Ashland Machine Co. et al., 682.

Placing the letters of the alphabet upon cubical blocks of wood, or spelling blocks, having been practiced many years, and also placing two such letters upon some of the blocks, it is not patentable to place two or more upon each block, even if they are placed more systematically, and with the design of rendering the blocks more useful. [Hill vs. Haughton, 8.

A patent for apparatus in which the acid and alkaline solutions for forming carbonic acid gas were kept separate until required to extinguish a fire, when they could be readily mingled, held void on its appearing that similar apparatus had been employed in soda fountains for the supply of beverages.

[N. W. Fire Extinguisher Co. et al. vs. Phila. Fire Extinguisher Co., 34.

The patent in suit was for the pilot truck of a locomotive engine resting on a bolster, and connected with it by a king bolt, on which it oscillated; the bolster being suspended from the truck frame by links diverging outwardly, so that when the engine moved laterally in passing a curve it was raised on that side, and its weight tended to bring it back to its normal position.

This arrangement was found to have been previously in use upon railroad cars; but in applying it to the pilot truck of an engine the operation and effect of it were held to be essentially different and useful, and the patent was sustained.

It appeared that a pilot truck had been previously patented, in which the engine rested upon, and was bolted to, a curved block, which moved on either side in a curved slot in the truck frame, so that the engine would oscillate around a point in rear of the truck, which was the center of the curves. Either the king bolt or the curved block might be made to rest on inclined planes, so that a lateral movement would raise the engine, and it would tend to settle back. Though these devices were regarded as the equivalents of those described in the plaintiff's patent, it was, nevertheless, held valid, because the previous patent made no provision for the oscillation of the engine on the king bolt.

[The Locomotive Engine Safety Truck Co. vs. The Penn. R. R. Co., 927.

PATENTABILITY.

Comminuted glue, or glue reduced to fine particles, does not differ in its qualities from flake glue, and a patent for it is void.

It is void, also, because such reduced glue has been known long before the grant.

[The Milligan & Higgins Glue Co. vs. Upton, 837.

A Burning Gas Well in Pennsylvania.

The following interesting description of a burning well in Pennsylvania has been received at the Signal Office in Washington from Mr. J. Cummings, of Tarentum, one of the volunteer observers for the Signal Service: "On the night of the 2d of February, 1875, myself, in company with several others, paid a visit to the great gas well, situated about nine miles from Tarentum and fifteen miles south of Butler, at a place called Lardius Mill, on the farm of Mr. Wm. Herney, and owned by a company consisting of William Herney, J. T. Vandergrift and J. McAllister. The well was tapped about ten weeks ago, as I learned from one of the proprietors, in their search after oil. They have gone down a distance of 1145 feet, and had just struck the 'first sand rock.' The well is located in a hollow about 300 feet wide, between abrupt hills. Our party came in the vicinity of the well about 9 o'clock at night, having seen the vast light floating in the sky on many a dark night on previous occasions thirteen miles distant; but when we came in its immediate influence, and saw the trees on either hand lit up, and their trunks and branches silvered to their tops by this burning torch, the scene was beyond description. On arriving at the ground we were met by hundreds of people from all parts of the country, who, like ourselves, flock nightly to see this great wonder. The first thing to strike the visitor on arriving is the great mass of fine, white flame, of intense heat and brightness, the hollow, rumbling noise heard as the outrushing gas plunges into the atmosphere and lights all around by its imposing brilliancy. The flame of this natural torch is about forty feet long and fifteen wide, and keeps at these dimensions night and day with striking regularity. Hence the light is both regular and constant. The heat emitted by so large a body of flame is very great. The trees all around at proportional distances are budding, and the grass that has not been trodden down by the throng of visitors is growing finely; and, considering this is midwinter, this circumstance will give you some idea of the great heat. I approached within 60 feet of the flame, and supposed it to be at that distance about 140°. The place has the appearance of a camp meeting at night, in consequence of the nightly crowds who congregate there. The light is grand. You can see to read with ease a quarter of a mile from this enormous gas jet, and if uninterrupted by trees and the wind of the road, reading could be done at the distance of a mile and a half.

The noise as the gas rushes out and is consumed is wonderful. It struck me as very much like the hollow roaring of a mighty river falling over a dam, uninterrupted and constant. This, together with the light and heat, fills the beholder with awe, and involuntarily leads him to reverence that Being who holds the earth, the air and the sea in the hollow of His hand. The sound of its roaring can be distinctly heard at a distance of four miles. One of the proprietors informed me that negotiations are going on for the purchase of this gas well by Dr. Hostetter, Graff, Bennett & Co., the Pennsylvania Salt Company, the Columbia Company, and others, who are studying the problem of utilizing this natural treasure in their various enterprises. The gas is conveyed from the well to the distance of about 150 feet by a six-inch metal pipe, and discharges itself at the end of the pipe with the percussive force of steam. There is another well of less note six miles distant, at a place called Saxenburgh, which also sends out a constant supply of gas. I may mention that the tools are yet in this well, which, if drawn out, would no doubt allow a greater volume of gas to escape.

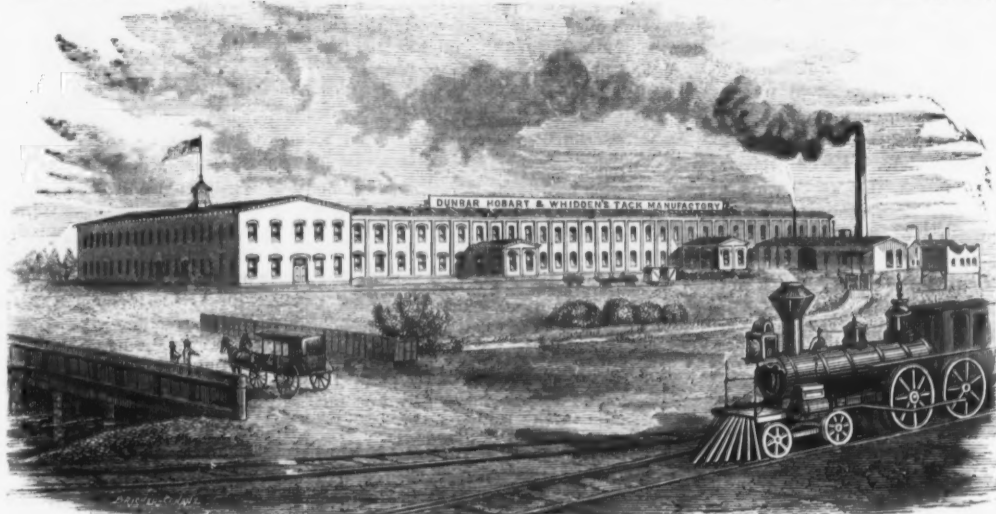
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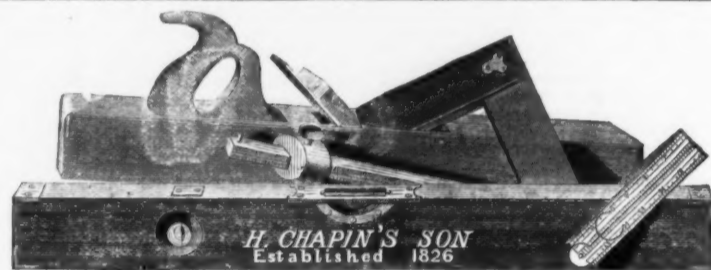
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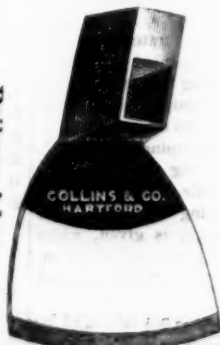
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Dense Castings.

A. Ledebur, of Groeditz, in Saxony, contributes a long and valuable paper on this subject to the *Berg und Huettenmaennische Zeitung*, from which we take the following:

In most cases we understand by a "dense casting" one in which the broken surface is perfectly homogeneous. This involves the absence of all hollow spaces like air and gas bubbles and weak spots, as well as the absence of substances mechanically mixed with the iron, which are partially foreign substances and partially secretions from the liquid metal itself. More rarely this expression refers to the texture of the metal, and especially in iron castings it signifies a fine grained structure not too rich in graphite.

In order to study the condition necessary for obtaining dense castings, in both senses of the word, we must become acquainted with the foreign substances, both solid and gaseous, the admixture or separation of which renders the casting otherwise than dense, and the properties of the metal to be cast as well as the conditions which render the texture so or so.

Holes or bubbles in a casting may be produced in several ways. The simplest way is when the atmospheric air, which fills the molds before casting, does not have sufficient chance for escape, and is compelled to seek an exit, wholly or partially, through the liquid metal.

Only in a few cases will the metal remain fluid long enough to permit all the air bubbles to escape; in most cases, and with all metals difficult to fuse, like steel, cast iron, bronze and brass, the air bubbles remain suspended in the solidifying metal, and afterward appear as holes, with smooth surfaces, on working or accidentally breaking the metal, the break frequently being caused by these imperfections. The danger of the formation of such holes, formed by the expelled air, is greater in compact castings than in weaker ones, not only on account of the larger volume of air to be displaced, but also because, for reasons to be mentioned hereafter, it is customary to use a less fluid and cooler metal the more compact the form of the casting. Hence it should be one of the principal objects of the molder to provide a sufficient escape for the atmospheric air. In what is called *green casting*, where a more porous material is employed for the mold, there is less danger, and it frequently suffices to penetrate the side of the mold with the wire generally used to make an air vent. In large castings, however, and in all cases where dry molds of dense, impermeable materials are used, air pipes must be provided.

The air expelled by the metal is not the only cause of bubbles and holes, since they may be caused by vapor and gases generated at the moment of casting. The moisture always present in the material used for molds, even when dried, is converted into steam by the hot metal; the black lead used to cover the mold, or mixed with the material used, forms carbonic oxide and hydro-carbon gas, beside other gases evolved from the straw and manure used to wrap the cores, &c. The violence with which these volatile bodies escape increases directly as their volume and inversely as the cross-section of the opening for escape, but the volume is for the greater part dependent upon the heat produced in the mold by the liquid metal, which both produces the gases and vapors as well as changes their volume by expansion. It has been noticed that when the "boiling" of the cast metal does not cease before the metal begins to solidify, its density is diminished by air or gas bubbles. Another danger is that the combustible gases produced may be mixed with air in the proportion to form an explosive mixture, which suddenly takes fire and seriously damages the mold. This is more likely to occur with hollow clay cores, through the air filled interiors of which the gases evolved seek an escape. Hence the precaution should be taken to fill such hollow cores with a porous material like sand, fire-clay or charcoal, which permits the free escape of the gas and prevents the collection of a volume of atmospheric air, thus reducing to a minimum the chances of forming an explosive mixture. In all cases the combustible gases, either from molds or cores, should be set on fire at first to prevent the collection of a larger quantity of combustible gas.

There is still a third cause for the formation of gas bubbles in castings. This is when the liquid metal contains dissolved gases which are liberated on casting, or when a gas is formed by contact with the air. Iron, especially, has the power of dissolving large quantities of gases. According to observations heretofore made, these gases consist principally of hydrogen, carbonic oxide and nitrogen. The power of dissolving gases is not the same in all kinds of iron, being smallest in coarse-grained coke cast-iron, which is rich in graphite, and largest in epegleisen, rich in carbon, as also in bright cast iron and steel poor in carbon.

The danger of injury to the density of the casting by the escaping gas bubbles increases also as the melting point of the iron is higher. Hence it is difficult to produce a dense casting of steel, which is rich in gases and melts at a very high temperature. For this reason gas bubbles occur more frequently in non-carbonaceous, generally more infusible, charcoal iron than in highly carbonaceous and more easily fusible coke iron; more frequently also in cast iron just from the blast furnace, where it has been exposed for a long time, and at a heavy pressure, to a mixture of gases rich in carbonic oxide, than in cast iron from a second fusion in a cupola or flame furnace. In some kinds of cast iron, long, vertical, and pear or funnel-shaped openings are often found showing that the gas was liberated at the moment of solidification.

Beside the escape of dissolved gases new gases may be produced by the contact of the flowing metal with the air. Most metals, when exposed to the atmosphere in a fused state, become covered with a film of oxide, and this oxide in turn, by giving up its oxygen, oxidizes the impurities in the metals, and the products of their oxidation in part rise to the surface (each as silicic acid), and there form new compounds with the metallic oxide; another portion, such as carbonic oxide and sulphurous acid, goes off as gas, producing the bubbles.

It frequently happens that in iron castings, which are otherwise dense enough, there are one or more round holes containing little iron pellets often as large as peas. These little iron bullets are produced by the spitting of the first portion of the iron which enters the cold mold, and usually show a white fracture when broken. They quickly become covered with oxide, and rise through the iron as it enters the mold. The film of oxide acts upon the carbon in the surrounding liquid iron, and form bubbles of carbonic oxide gas. If the iron is very strongly heated while casting the gas goes and the pellet of iron fuses again without doing any permanent damage. If the iron is not heated much above its melting point the pellet is found, on working the iron, surrounded by its envelope of gas. The reason why this occurs oftener with iron that has a high melting point than with the more fusible sorts is because the former solidifies quicker and at a higher temperature.

Exactly the same formation of gas takes place when wrought iron supports are used for the cores, and have not had the rust removed by acid or by filing, better still by tinning. These bubbles are always seen about these cores.

The holes produced in the iron by the above mentioned causes, whether from air or gas bubbles, are all more or less round or elongated and have smooth surfaces.

Beside these round, smooth holes, there are frequently jagged holes with the surface covered with minute crystals. They occur most frequently in alloys of copper and zinc, the broken surfaces of which are covered with indentations varying in size from a pin-head to a walnut. These are due to contraction on cooling. Compact castings solidify on the surfaces most exposed, and contracts against the still liquid portion within, which has not yet contracted. When the last portion solidifies and contracts, it leaves one of these open spaces, and at the moment of solidifying crystallizes. The size of the hole is, of course, directly proportional to the size of the casting, the temperature of the metal when cast, and the coefficient of contraction. If we suppose the flow to be in the portion that cooled last it is not difficult to tell about where it is. These flaws are especially bad when two parts of very unequal diameter cross each other, and sometimes cause the smaller one, which cooled first, to break away from the larger one. For this reason such shapes are avoided if possible.

The flaws increase, too, with the difference of temperature between the temperature of the metal poured in and that of the solid metal, and hence they are frequently found near the spot where the metal is poured in. Finally, they are dependent upon the amount of contraction. The linear coefficient of expansion for cast iron is taken as 1.96, for zinc 1.80, for brass 1.62 of its length. Just as these figures increase, so does the difficulty of avoiding the formation of these holes.

Ledebur observed that a brass plate, which had been cast of strongly contracting metal without the necessary precautions, after planing off the outer rim, split into two plates, covered with crystals on the inside. These plates were held together only by the outer rim which had cooled first.

The tendency of cast iron to form these hollow spaces varies with the coefficient of contraction, which Ledebur says is different in different kinds, ranging from 1.125 to 1.62. The separation of graphite is an important factor here. Bright white cast iron has more of these flaws than gray, and pure charcoal iron with but little graphite more than gray coke iron with more graphite, while coarse grained Scotch cast iron, rich in silicon and graphite, and which contracts but little when melted alone, has the least flaws of any.

Among the mechanical admixtures which injure the density of the iron, it is scarcely necessary to mention particles of carbon, slag, &c., from the molds or from the lining of the casting vessels. In most cases the skill and care of the venter and the selection of good molding sand prevent these substances from injuring the iron. It is not so easy to get rid of substances that separate from the metal itself before or during the casting. It is mostly the products of oxidation, formed by the liquid metal coming into contact with the air, which thus injures the casting. Iron, copper, tin, zinc and lead are all metals which readily take up oxygen when in a liquid state. These are still more readily oxidizable because they are never perfectly pure, but contain foreign substances which oxidize themselves, and their oxides combine with the oxides of the metal to form salts. In some metals, particularly certain kinds of cast iron, the quantity of easily oxidizable foreign matter is so great that the whole surface becomes covered with a film in a few seconds. Such iron usually contains a good deal of silicon, and is called "impure" or dirty iron by foundry men.

It has already been shown that the products of oxidation may also injure the iron indirectly by producing gas bubbles.

In some kinds of cast iron, when it is heated considerably above its melting point, a portion of the dissolved carbon crystallizes out, and being lighter than the iron, rises to the top, where it forms a spongy, crystalline structure, marring the whole casting.

The texture of cast iron is the result, the visible expression, of its attempt at crystallization on solidifying. This attempted crystallization is influenced by the constituents of the

cast iron, as well as by the other circumstances during the cooling. The more graphite there is dissolved in the liquid iron, and the slower and more quietly it solidifies, the larger grain and more crystalline the texture of the cast iron. In a large casting the solidification begins at the surface and proceeds gradually inward; as the exterior solidifies more rapidly than the interior, the texture is never perfectly homogeneous, being finer grained the nearer it is to the edge, and coarser grained the farther it is from the surface.

The separation of graphite and the formation of texture go hand in hand, or, rather, the latter is dependent on the former. The influence of slow or rapid cooling is not the same on all kinds of cast iron under otherwise like conditions. Some kinds, from easily reducible and difficultly fusible iron, even when rapidly cooled, have a distinctly crystalline, granular structure, with an intermixture of graphite scales. Others, from easily reducible and easily fusible ores with manganese in them, on cooling rapidly, hold all the carbon in combination and show a white, radiant fracture. In certain cases the latter property is employed for making hard castings with white surface and gray interior, but may, under other circumstances, where a soft homogeneous casting is required, act injuriously.

Only in rare cases is an uneven structure in cast iron due to other influences than the conditions of solidifying. Sometimes, when different kinds of cast iron, hard and soft, are mixed and melted together, there will be found lumps of dense hard iron in the middle of the softer and coarser grained mass. This phenomenon indicates that certain kinds of iron are unwilling to unite with those of very different properties to form a homogeneous mixture, and it would be well to bear in mind this property of many kinds of cast iron when selecting iron for castings.

Ledebur next cites some cases where the upper portion of a casting was found to contain more graphite than the lower, and advances a theory to account for it.

We pass on next to a consideration of the different means employed to produce dense castings.

In the first place, if one part of the casting is more important than another, this is put at the bottom. This simple remedy has been found generally efficient. All foreign substances, whether gas or solid, that injure the density of the casting are lighter than the iron, and hence rise to the upper part, whilst the lower portions of the casting are quite free of them. In most cases the iron enters the mold from the top, and the upper part cools last. The flaws due to contraction, we have seen above, are in the part that solidified last.

The position, whether top or bottom, does not have the influence that many suppose upon the texture of the iron or other metal. The arrangement of the molecules, we have seen, result solely from the influences of cooling and the composition of the cast iron, not being changed by the static pressure of so short a column of iron.

If the casting is one that should be dense and free from flaws and foreign substance, not in one part only, but in all parts, the casting is made higher than necessary, and the superfluous portion above, called the "lost top," is afterward broken off and melted over. There are two principal conditions to be fulfilled by this "lost top." In the first place, it should receive all the foreign substances rising from the liquid iron, and thus remove them from the casting. This object is easily accomplished by a little care. In the second place, it should not solidify until after the casting, so that the flaws due to contraction shall be in this last fluid portion. To accomplish this the section as well as the height of the top must be carefully regulated to the form and size of the casting. In spite of this the object is not always entirely accomplished, because the shape of the casting sometimes prevents the construction of a suitable top. It is customary to assist its action by keeping it open as long as possible by moving an iron rod up and down in it, and diligently pouring in fresh iron until perfectly solid. Pouring in a fresh quantity of very highly heated iron, is undoubtedly an advantage, but poking it with a rod is a doubtful aid, as the cold rod chills it somewhat. It seems more advisable to keep the top as warm as possible by throwing on hot coals, and when a crust begins to form, to break it through and pour on very hot iron until solid. Very high and heavy tops do not affect the structure through their hydraulic pressure, as generally supposed.

When it is desirable to make a cylindrical casting, with a pure and dense surface, as for all kinds of massive rollers, the iron is allowed to enter the upright mold in a tangential direction, so that it fills the mold by a circular motion. The centrifugal force throws the heavier iron to the circumference and separates it from its impurities which seek the center, where they also ascend more easily. Although this process is ingenious, and has been successful in many cases, yet it must not be forgotten that the not inconsiderable centrifugal force may tear off pieces of the mold, either sand or black lead, so that the shape is injured, or, at least, the density of the iron is impaired by the admixture of this foreign substance, which does not usually have time to reach the center. To avoid this the best quality of molding sand must be used, and a carefully prepared black lead, or dust, and great care must be taken in blacking and drying the mold.

The sort of iron employed, of course, effects the density of the casting. It is more difficult to make dense castings with iron that dissolves a considerable amount of gases which are set free before it solidifies; or with iron that oxidizes readily or contains a large amount of easily oxidizable elements; or that has an tendency to cover itself with a film of graphite crystals;

or with that which contracts much; iron that melts at a very high temperature is more liable to contain little pellets caused by spitting. Practice and care seem to be the best teacher on this point. These kinds of iron with which it is difficult to make dense castings, mostly possess other properties that make them valuable to the founder, and hence they are generally combined with iron of a different quality so as to neutralize the bad properties and unite their good ones.

It is also to be observed that the texture of every casting depends on the time consumed in cooling, and indirectly on the size. To obtain a fine grained structure, a finer grained and less graphite iron must be selected if the casting is large and compact; coarser grained and more graphite if casting is small.

The manner of smelting must also be taken into consideration. Flame furnaces produce a different product from cupola furnaces, and these again different from fusion in crucibles. With iron the texture is finer, the amount of graphite less, and the quantity of foreign and injurious admixtures also less the longer the melting or melted iron is exposed to the air. Hence it is preferable to cast large rollers, cylinders, &c., which require a fine grain and pure iron, from a flame furnace, while for the ordinary purposes of the foundry the rapidly smelting cupola furnace, which exposes the iron but little to the action of the blast, furnishes more suitable material.

Finally, the temperature of the fused metal, especially of iron, on casting, as well as the treatment before casting, are of no small importance in obtaining a dense casting. The less the metal is heated above its melting point, the more difficult it is for any foreign substances in the metal to rise to the top, and hence the greater the danger that the cast will be a failure, aside from the danger of solidifying before the mold is entirely full. The hotter the metal on pouring, the greater the danger of flaws by contraction. There is, however, a middle course by which both dangers are avoided. The metal is drawn very hot into the ladles and allowed to stand until of a proper temperature to pour into the molds, which depends on the size and shape of the casting, while the foreign substances have time to separate. To aid this separation the metal is constantly stirred. This manipulation is more important than most persons suppose. Dissolved gases escape more readily from the liquid when in motion than when quiet, and burn on the surface of the bath with little blue and white flames. The crystallized graphite rises to the surface, the silica forms silicic acid and rises also to the surface where it combines with the oxides already there. By skimming off the surface a refining process on a small scale is carried on, in which the oxygen of the air as well as the basic slag formed on the surface serve as powerful agents. The cast iron becomes purer, not only from substances mechanically mixed with it, but from foreign matter dissolved in it, hence the casting becomes denser and the texture of a finer grain. The bath must be carefully skimmed so that the metal shall have a clean surface when poured into the mold.

Undoubtedly, much may be truthfully said against corporate uses of capital. Many enterprises are undertaken by companies which could be much more successfully worked by private individuals. In the management of companies there is less inducement to industry, caution and economy than exists in the conduct of a private undertaking. The motive of self-interest operates less directly and with less force; and experience has demonstrated in too many cases that the private interests of managers are put in conflict with the interests of the corporation. In short, it is claimed that for a corporation to be as successful as a firm in the prosecution of any undertaking, it has to be assumed that the sense of duty and of high moral principle will be as efficient a motive in its management as self-interest—an assumption altogether too flattering for these times. Nevertheless, on the other hand, experience proves that individuals and firms do not always possess the wisdom and prudence that are to be found in the collective councils of a well regulated company. The truest test of the com-

parative excellence of methods is to be found in success; and, applying this rule, we shall not find corporate enterprise generally at a disadvantage. Failures of corporations are comparatively infrequent; private failures are of every day occurrence; and it may, perhaps, be reasonably questioned whether the private employment of capital, taken on an average, yields a better return than capital invested by corporations.

The popular prejudice lies chiefly against large corporations, and the common charge against them is that they are "monopolies." This much, however, is to be said for them, that they have become large through being successful; that they have become successful, as a rule, through conferring important advantages upon the public, and through rendering such services better than others; for that is the real meaning of success in all enterprise, whether private or corporate. It is further to be said, that while the ascendancy which their success gives them may tend to drive out of the field numerous minor competitors, and thereby tempt them to an abuse of their power, yet the more complete their success becomes, and the larger their profits, the greater is the inducement for the formation of other large combinations of capital to enter into competition and check their rapacity and enforce thorough methods of management, and to secure for the public such services as it may be their business to render at the lowest possible cost. Thus it is a law in the corporate employment of capital that one great successful company calls into existence another or others, and that the competition thereby created protects the public against corporate wrongs and abuses, and results in advantage to the people at large. This at least is the rule, and the only exception is in cases where the business to be done is so limited as not to admit of any indefinite extension of competition.

The very class of companies against which the outcry of monopoly has been most loudly raised is the one in which this law has worked most conspicuously. The echoes have not yet died out of the clamor raised against some of our leading railroads for consolidating a number of minor roads into one great company; and yet we already see these mammoth corporations, which were to be the oppressors of our commerce, engaged in a deadly struggle for the trade of the country. Every attempt made between them to agree upon common rates of freight has almost instantly broken down, and it is demonstrated that henceforth they can regard each other only as enemies, destined to perpetual conflict. The fight between these gigantic competitors has reduced the charges for inland transportation lower than they were ever known in the history of the country. Their anxiety to carry off the prize of traffic compels them to adopt every form of improvement, to resort to every method of economy, to shorten distances and to increase speed, and to afford to the mercantile public every possible accommodation and convenience.

It is impossible honestly to deny that these results have followed, and are likely to be realized in a still larger degree from the great railway consolidations that have been effected within late years. It is a singular reflection upon the sagacity of a class of zealots and perhaps well-meaning mercantile agitators, that the very causes which they denounced as threatening the ruin of our trade should have been the means of bringing about the "cheap transportation" which they declared the railroads would never voluntarily afford. The cheapness and the protection which they have combined to demand through legislative enactments and Congressional control, and mammoth government railroads and federal canals has already come unasked for from the railroads themselves. We may take it as settled that railroad consolidation has solved for this generation the question of cheap transportation. With four great trunks, extending their arms to every part of the Continent, and each one eager to grasp from the other the traffic within its reach, the public need no other protection than such as will arise from the efforts of the competitors to outlive one another in the completeness and cheapness of their services. The mission of the Grangers, of cheap transportation associations, of "Potter laws," and of Congressional railroad commissions, is therefore ended; and the sooner these agencies cease to parade their quack remedies for what is no longer a public disease, the sooner will confidence be restored to railroad investments, and capital be again contributed to maintain that activity of competition which is necessary to keep down the rates of rail transportation.

Automatic Gas Lighter.—Instead of electricity for lighting gas, Baumister employs a small accessory flame, which burns all day, with a consumption of 0.04 cubic feet per hour, or even less, though when less than 0.03 cubic feet, the flame is liable to be extinguished by draft. By regulation of the pressure, this flame is made to flare up and ignite the principal jet, and it then goes out; and again, by a change of pressure, the principal flame is extinguished, and the small one relighted, and the flow of gas to the principal burner again completely checked. There is also an attachment, which, under the average pressure, allows only a definite flow of gas through the burner, and which, it is suggested, can also be arranged as a simple and convenient pressure regulator.

Election of Officers of the Milwaukee Iron Co.—At a recent election the following gentlemen were chosen officers of the Milwaukee Iron Company: President, J. J. Hagerman; Treasurer, Alexander Mitchell; Secretary, pro tem, John H. Van Dyke. Directors, Alexander Mitchell, Milwaukee; John H. Tweedy, Milwaukee; Chas. F. Hilsley, Milwaukee; John H. Van Dyke, Milwaukee; S. P. Burt, New Bedford, Mass.; O. W. Potter, Chicago; J. J. Hagerman, Milwaukee.

Great Corporations.

We take the following from the *Daily Bulletin*:

It has long been the fashion to decry large corporations. They are stigmatized as oppressive. It is charged that they ruthlessly suppress the competition of smaller enterprises; that they conflict with that healthy development which starts with small beginnings; that they are selfish and can live only by crushing out all opposition; and that having succeeded in clearing their path of opponents, they become recklessly exacting in their demands upon the public. Upon these grounds, great corporations are denounced as enemies of the public welfare, and to be placed under the most rigid legislative restrictions and under strict government surveillance. Within the last three years, the Grangers have come forward as the special exponents of this idea. In Iowa, Illinois, Wisconsin and Ohio, they have procured the enactment of laws specifically intended to restrain the free action of railway corporations. They have encouraged similar legislation as against insurance companies. Just now, they are demanding in the legislature of this State the adoption of a special tax upon the capital of all corporations. And conscious that the great enterprises ordinarily executed by the large companies against which they are crusading must nevertheless be undertaken by some concentration of power, they are found backing all sorts of schemes of governmental enterprise, including the construction of canals, the building of railroads, the working of telegraphs, etc.

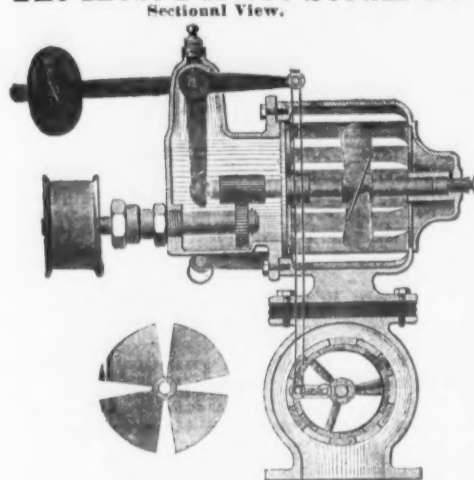
Undoubtedly, much may be truthfully said against corporate uses of capital. Many enterprises are undertaken by companies which could be much more successfully worked by private individuals. In the management of companies there is less inducement to industry, caution and economy than exists in the conduct of a private undertaking. The motive of self-interest operates less directly and with less force; and experience has demonstrated in too many cases that the private interests of managers are put in conflict with the interests of the corporation. In short, it is claimed that for a corporation to be as successful as a firm in the prosecution of any undertaking, it has to be assumed that the sense of duty and of high moral principle will be as efficient a motive in its management as self-interest—an assumption altogether too flattering for these times. Nevertheless, on the other hand, experience proves that individuals and firms do not always possess the wisdom and prudence that are to be found in the collective councils of a well regulated company. The truest test of the com-

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For Stationary and Marine Engines.

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The Most Perfect Steam Governor in the World.



Largely in use by the U. S. Government at Treasury Department, State and Custom Houses, Navy Yard, and U. S. Vessels.

Also by leading manufacturing establishments, Rolling, Saw and Paper Mills, Tanneries, etc., throughout the country, where the most positive uniform speed is required. The use of this Governor insures

A positive saving in Steam of from 10 to 20 per cent. over any other Governor in use.

This Governor possesses no characteristics in common with others, either in principle or operation. We refrain, therefore, from entering into comparisons. The Centrifugal or Ball Principle is entirely abandoned in this invention, and the valve lever is sustained with the same velocity in one position as another. No matter how great, violent or sudden may be the changes of load, we warrant it to

Absolutely Govern the Engine,

which will run uninfluenced by the varying pressure of steam, be it thirty or eighty pounds. In a moment's time the revolutions of the driving wheel can be changed to exactly the speed required without stopping any of the mechanism, remaining perfectly governed wherever set.

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Pure Bronzed Metal and Hand-Plated Knobs, Hinges, &c.
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Sold to the Hardware trade only.
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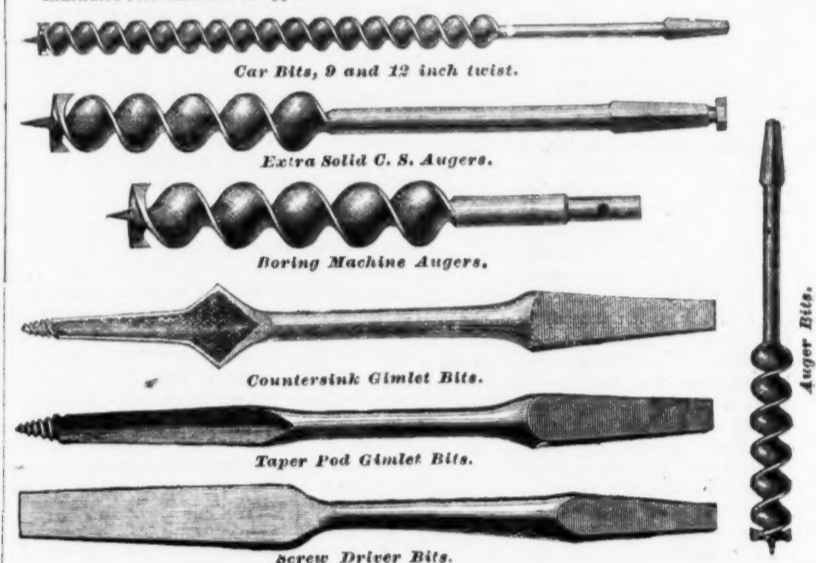
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Warranted.



"BEAVER"
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FILES AND HORSE RASPS
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IT HAS THE LARGEST SALE OF ANY LAWN MOWER IN THE WORLD.



It has been adopted and can be seen in practical operation on Central Park and all the other City Parks, New York; Government Grounds and City Parks, Washington; Boston Common, Boston; Prospect Park, Brooklyn; and on almost every prominent Park throughout the United States and Canada. Four sizes for hand-power; four sizes for horse-power.

Prices from \$15 to \$200. EVERY MACHINE WARRANTED.

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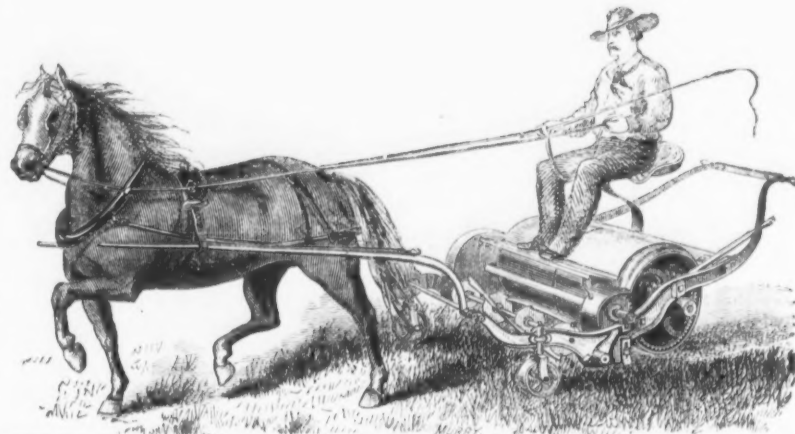
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The Great Trial.

At the trial held in New York city, on the 25th of June, 1874, the New Excelsior was awarded the First Premium (a Silver Medal) by the American Institute, in competition with all the different Lawn Mowers now made in this country.

The New Jersey State Agricultural Society, at its Annual Fair, in September, 1874, awarded the New Excelsior the highest honor and the First Premium (a Silver Medal) after a full and fair test of its merits as compared with three other of the principal Lawn Mowers now in use.

This Proves THE EXCELSIOR the best Lawn Mower in the World.

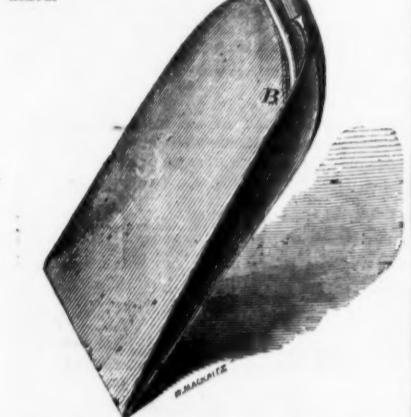


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An improvement giving great strength to the weak point of ordinary shovels. The corrugation is from A to B on both sides, not sensibly increasing the size of handle.

Hardware buyers' attention is called to the fact that this improvement will command the market.

We are prepared to fill orders for Ames', Rowland's, and Myers & Arnold's Scoops and Back Straps, with the patent Corrugated Straps, at \$1 per doz., net, above price of regular goods, shipping direct from the factories. Sample orders asked.



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Made of Wrought Iron or Brass, very superior in quality, and only an auger used in mortising.

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Solid Cast Steel Carpenters' and Machinists' Hammers, Mining Sledges and Blacksmiths' Tools.

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First-class Makers of Machinery & Specialties, &c., desirous of extending their exports, will find it in their interest to supply with full particulars and prices, &c., &c.

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SPENCERIAN
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Were sold in 1874—being a gain of more than 1,000,000 over the year previous; this, with the marked increase in the sales of the other numbers, shows that the superior quality of these Pens are being more and more appreciated, and that they are destined to take their place as the most popular Steel Pens in the market. They are made of the best steel, by the most skillful workmen in Europe, and are a nearer approximation to the real Swan Quill action than anything of the kind hitherto invented.

The Spencerian Steel Pens are universally used in the Commercial Colleges throughout the U. S., more largely than any others by the United States Government, and quite generally in the Banks, Counting Houses and Schools of the country; and are for sale by the trade generally.

We claim for the Spencerian, superiority over all other pens in durability, elasticity, flexibility, and in evenness of point.

* * The Spencerian Pens are comprised in 15 numbers, varying in flexibility and fineness of point, and, for the convenience of those who may wish to try them, we will send a card containing a sample of each number by mail, securely enclosed, on receipt of 25 cents.

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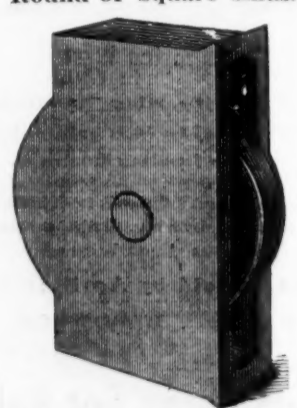
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Drum's Pat. Axle Pulley.

Round or Square Ends.



The best and cheapest pulley in the market. No flange to mortise in. No screws required. Over 60,000 sold in the West alone. Satisfaction guaranteed. Send for price list.

LIVINGSTON & CO., Pittsburgh, Pa.



Standard Bellows.
SCOTT'S

Emery.

A recent number of the Emery Grinder contains an article under the above title, from which we condense the following:

Emery is a variety of corundum, or, it is of the same mineral species of which corundum, sapphire and oriental ruby are varieties, and agrees with them very closely in composition, hardness and specific gravity, but in appearance it is dull and opaque and though its masses are very compact, they are not crystallized.

Emery was long regarded as an oxide of iron, and was called by Haüy *Per oxide quartzifere*, hence it is sometimes called by mineralogists ferruginous corundum, because it contains a certain quantity of iron.

SOURCES OF SUPPLY.

The crude emery stone has never been found in any considerable quantity for consumption, except in the countries bordering on the eastern part of the Mediterranean Sea, near Smyrna on the Asiatic continent, and on the contiguous island of Naxos, from which two sources all the world is supplied.

Emery is very abundant in the island of Naxos, at Cape Emery, which is the property of the Greek government. Dr. Lawrence Smith, the American geologist, while residing in Smyrna, made a discovery of a deposit of emery. He made an examination of the locality in 1847, and having reported his discoveries to the Turkish government, a commission of inquiry was instituted and the business soon assumed a mercantile form. All that is used at present in the arts, comes from Turkey, near ancient Smyrna, and from Naxos, which sources seem to be the same geological deposit reaching under the sea from the Continent to the island, in the same manner as the basaltic formation of the Scotch Fingal's Cave and the Irish Giant's Causeway, stretches under the Irish Channel.

CONSUMPTION OF CRUDE EMERY.

The contractors who work the Turkish and Greek mines, are obligated to mine, at each, from 2000 to 2500 tons per annum. The maximum annual product and the total consumption of crude emery for all uses does not exceed 5000 tons, and often falls below that quantity, of which the Wellington Mills, London, consume one-fourth of all that is yearly mined.

PROCESS OF MINING CRUDE EMERY.

The mining of emery is of the simplest character; the natural decomposition of the rock in which it occurs facilitates its extraction. The rock decomposes into an earth, in which the emery is found embedded. The quantity procured under these circumstances is so great that it is rarely necessary to explore the rock. Its color varies from red brown to dark brown. Its specific gravity is about 4.4, and it is so hard as to scratch quartz and many precious stones. The earth in the neighborhood of the block is almost always of a red color, similar to red oxide of iron, and serves as an indication of its proximity to those who are in search of the mineral. Sometimes, before beginning to excavate, the spots are sounded by an iron rod, with a steel point, and when any resistance is met with, the rod is rubbed in contact with the resisting body, and the effect produced on the point enables a practised eye to decide whether it has been done by emery or not. The blocks, which are of a convenient size, are transported in their natural state, but are frequently broken by large hammers. When they resist the action of the hammers, they are subjected to the action of fire for several hours, and on cooling they commonly yield to blows. The crude stone is shipped in blocks of various sizes, from 150 lbs. in weight down to pieces the size of an egg, but larger stone is preferred, being more compact and hard. It sometimes happens that large masses are abandoned, owing to the impossibility of breaking them into fragments of a size convenient for transportation to the seacoast, camels and horses being the only means of transportation.

From the foregoing description of the collection of crude emery, it will be evident that much stock of inferior quality is shipped. This is disposed of to crushers or to their purchasing agents, who knowingly choose the lower priced stock, or, ignorant of the varying product of a mine, are deceived by the lower price of the poorer stone. Inferior emery is therefore sometimes produced from Turkey or Naxos stone, because sufficient care or knowl-

edge is not used in the selection, or because it is not skillfully and faithfully manufactured.

EXPORTATION OF EMERY.

With the exception of small orders which are sometimes sent to Smyrna commission agents for crude stone to be directly shipped to U. S. A., for use of American crushers, the entire product of emery is sent forward by the contractors to England, and all crushers are supplied from the stock of crude stone there.

MANUFACTURE OF EMERY.

The large pieces are broken up by the emery manufacturers by use of steam hammers or hand sledge hammers to a size convenient for placing in Blake Bros. American patent crushers, which machines reduce it to the size of a walnut; these are again placed under stampers, rollers and crushing machines until the whole is reduced to the required fineness; it is then conveyed to the sifting machines to separate the various grades of grain; the meshes of wire used for obtaining the various grades vary from sixty holes to many thousand holes in the square inch. The manufacture of crushed emery is very destructive to all the machines employed in crushing and assorting the grain, owing to its abrasive quality, which fast wears away all metal with which it comes in contact. The final process of sifting and grading the emery requires great care, skill and judgment to obtain an accurate and uniform grain of the several grade sizes.

The process, moreover, is necessarily a disagreeable and dirty one, as the air of the apartment is filled by the fine dust of emery, and being inspired into the lungs is irritating at all times, and, indeed, is no doubt often permanently injurious to them.

DIFFICULTIES OF MANUFACTURERS.

The difficulties that beset the trade of emery crushing are manifold; by a recital of them, it may cease to be a surprise that consumers have experienced such frequent loss and annoyance in its use, and that they are only slowly learning by experience the false economy of attempts to use any but the very best standard and known quality. We therefore proceed to call attention to the difficulties that hinder the production of really reliable emery, and which have hindered consumers from obtaining it with certainty when produced.

First.—The crude emery, in mass, is very far from being of uniformly good quality, even when it is shipped in hard, compact and heavy pieces. Tennant's analysis of a very fine cabinet specimen showed 80 per cent. grit, while his analysis of some other specimens showed only 50 per cent. grit.

Second.—It will be noted, from the description of the condition of the mining sources, that disintegration of the stone exists in the mines; in a long lapse of time the particles have become crumbly, and the red earth in which the masses are formed is the debris of the perished stone. This deterioration toward a crumbling state in much of the mass is in actual operation, though partial, and renders each mass more or less susceptible of dissolution into atoms by abrasion in the degree of its progress toward decay from its primitive compact state.

Third.—The laborers are not more faithful in oriental than in occidental countries to expend voluntarily their efforts to invariably secure the stone which is hardest to work, as their wages are dependent on the weight mined.

Fourth.—The bad faith of the Greeks is proverbial, and the Turks are in little better repute; their government inspectors have no incentive to do more than secure the pay for all that is obtained, regardless of its quality, and therefore the contractors' agents have not at all times the very best chance to get the best quality, even if they were fully faithful to their employers' interest.

Fifth.—The pulverization and grading of a quantity of stone produces sizes, proportionate quantity of the several grades of which is quite uncertain. This uncertainty is dependent on the quality of the lot of crude stone, and, to a certain extent, on the skill in the work, but skill cannot largely control the relative proportion of sizes yielded.

Among the largest crushers of emery in the world are the Wellington Mills, London, the excellence of whose product, under a copyright label, has gradually and surely brought their emery into use among some of the largest and

most critical consumers, and they have twice been compelled to enlarge their mills and business premises to meet the demands made upon them. The site of the mills—the total area of which is 38,800 feet—has a frontage of 155 feet in the Westminster Road, and runs back along Mead's Row for a distance of 340 feet in a straight line. The plan is that of a hollow square, with the warehouse and offices fronting the Westminster Road, the factory premises on the other three sides, and the chimney stalk, boilers, engines and stampers (for crushing glass and emery) in the center. The warehouse, Italian in its general proportion and details, is 85 feet long, 50 feet wide, and 57 feet high; the basement, 10 feet high, is used for the storage of goods and stores; the ground floor, 14 feet high, with its central entrance and three windows on each side, is faced with Portland stone, and contains the offices (home and export), the sample rooms, &c. Above this are three stories, each 11 feet high, faced with white gault bricks, with stone string courses, molded brick reveals to windows and terra cotta cornice. The floors are formed of 2 in. flooring, on joists 12 in. by 3 in., carried by 12 in. rolled iron girders, and these are supported by cast iron columns 10 in. diameter in the basement and decreasing to 4½ in. in the top story. A wide and handsome pitch-pine staircase communicates from the ground to the first floor; a workmen's stairs leads from the basement to the roof. Lavatories, &c., arranged on each story, and a steam lift runs up throughout the entire height. Adjoining this warehouse, with its bold iron railing next the road, is the entrance for carts (which pass over a weighing machine on their way to the yard), and a campanile, 60 feet high, flanks the gateway at its southern angle. Next follows the gate-keeper's residence and then the factory proper. This consists of a continuous range of workshops, 500 feet long by 30 feet wide, and three stories in height, in which the various processes of manufacture are carried out. The machinery is worked by three engines, of which two are 20 horse-power, in the wings, whilst the third, of 40 horse-power, is placed in a separate one-story building in the hollow of the square above mentioned, where are also the boilers, four in number. At the apex of the triangle forming the site, there is a range of stabling for twelve horses, loose boxes and infirmary, with harness room, keepers' house, hayloft, boiler room, and a large cart shed. The chimney stalk is a prominent object, not only in the immediate neighborhood, but for some distance around; it is octagonal in plan, 100 feet high, with ornamental bands, &c., in white glazed and colored bricks, and is surmounted by a handsome cast iron capital, weight about 6 tons, the foliation of which is picked out with gold. Adjoining this is a well 330 feet deep, for the supply of water to the works.

Architectural Iron Work in Richmond, Va.—The Richmond Engineer says: Messrs. Aas Snyder & Co., of the Richmond Architectural Iron Works, having the contract for the erection of the iron gallery of the State, War and Navy Department library at Washington, have put together at their establishment the third tier of the gallery, and in pursuance to information received to this effect, we recently visited their works. The tier consists of some eight alcoves, nine feet high, opening out upon a balcony, which rests on iron beams extended from the floor. The space between the four sides of the tier is about 24x34 feet, the size of the rotunda; the spandrels of the alcoves are sprung each from a fluted pilaster with highly ornamented capital connected with a pannelled plate, so beautifully joined as to present the appearance of being incised. The spandrel plates are also beautifully ornamented in relief, and the railing of the balcony exhibits a most complicated pattern. The book shelves of the tier number about 400, and are bolted to the pilasters and arches of the alcoves, thus making the structure one of immense proportions. The chief merit of the work, however, is in the completeness of its workmanship. We made a careful examination of some of the most difficult joints and were astonished at their closeness, and the evidence presented of what skilled mechanical labor could do with such material. We also saw in going through the establishment a magnificent iron front, which we learned was for the new Piedmont and Arlington building, corner of Ninth and Main streets.

Trade Report.

Office of THE IRON AGE.

WEDNESDAY EVENING, March 10, 1875.

The past week has witnessed a general revival of speculative activity in Wall street, especially in the stock and gold markets. In the former the "bull clique" and the "bear clique" have both been very active, and much excitement has resulted from these operations. In the money market borrowers on call have paid rates varying from 2 to 4 per cent., and prime mercantile paper has been discounted at 5 to 7 per cent.

In the stock market, as above noted, there has been an active speculation, with very heavy dealings at steadily advancing prices. The favorite stocks have been Pacific Mail, Western Union, Union Pacific, Northwestern, Lake Shore, St. Paul and Rock Island. The highest and lowest of to-day's quotations of active shares are given below.

The gold market has been very much disturbed, principally by the operations of the "bear clique" in the stock market, who bought nearly two millions of gold and locked it up, making borrowers pay as high as 3-16 of 1 per cent. per day for its use.

The following shows the daily range of the premium since our last report:

	Highest.	Lowest.
Thursday.....	115 1/4	115 1/4
Friday.....	115 1/4	115 1/4
Saturday.....	115 1/4	115 1/4
Sunday.....	115 1/4	115 1/4
Monday.....	115 1/4	115 1/4
Tuesday.....	115 1/4	115 1/4
Wednesday.....	115 1/4	115 1/4

Government bonds are firm, but the dealings have been limited on account of the uncertainty which exists regarding the Treasury policy. On Monday it was semi-officially announced from Washington that within the next few days the Treasury would call in \$30,000,000 5-20s on the sinking fund, which announcement will probably be made good on Thursday or Friday of this week. The call will probably be confined to registered bonds, but, in the absence of official information, this is still uncertain. The reason for this is that nearly all the coupon bonds are held in Europe, and to redeem them would involve a heavy specie shipment to foreign markets. This is evidently contrary to Mr. Brewster's policy. How much of the \$30,000,000, gold, to be paid out by the Treasury, will remain at home, and how much will go abroad, remains to be seen. The prospect of a considerable increase in the gold reserves of the banks between this and June 1st should have a favorable effect upon general business, as it will insure steadiness and ease in the money market—the banks being at liberty to expand their credit to four times the amount of their gold and legal tender reserves.

The following trade movements for the week are shown as follows:

	1873.	1874.	1875.
Total for week.....	\$9,454,893	\$8,434,511	\$10,519,538
Prev. reported.....	73,070,728	62,042,909	58,016,053
Since Jan. 1.....	\$82,475,621	\$70,686,452	\$68,535,586

Among the imports of general merchandise were articles valued as follows:

	Quant.	Value.
Antimony.....	6	\$495
Arum.....	62	620
Brass goods.....	13	2,070
Bronze.....	9	3,077
China and anchors.....	366	9,483
Copper.....	107	107
Cutlery.....	106	57,558
Grass.....	9	9,549
Hardware.....	144	17,806
Iron, pig, tons.....	1,169	31,292
Iron, other, tons.....	470	1,834
Lead, pigs.....	5,268	34,041
Metal goods.....	484	30,398
Nails.....	19	1,909
Needles.....	22	6,664
Old metal.....	1	4,346
Per caps.....	34	5,076
Saddlery.....	4	4,068
Steel.....	42,783	42,783
Spelter.....	55,307	3,538
Silverware.....	2	410
Tin boxes.....	40,316	386,818
Tin (6,646 slabs).....	444,013	83,518
Wire.....	568	8,802
Zinc.....	409,758	24,705

EXPORTS, EXCLUSIVE OF SPECIE.

	1873.	1874.	1875.
For the week.....	\$5,098,314	\$5,338,161	\$5,349,000
Prev. reported.....	44,999,915	47,412,349	49,361,336
Since Jan. 1.....	\$49,696,289	\$52,720,510	\$44,003,336

EXPORTS OF SPECIE.

	1873.	1874.	1875.
Total since January 1, 1875.....	\$13,555,802	\$12,566,727	\$11,235,942
Same time in 1874.....			
Same time in 1873.....			

Government bonds closed firm at the following quotations:

	Bid.	Asked.
U. S. Currency 6's.....	119 1/4	119 1/4
U. S. 6s 1881, reg.....	119 1/4	119 1/4
U. S. 6s 1881, cou.....	119 1/4	119 1/4
U. S. 6s 1882, cou.....	119 1/4	119 1/4
U. S. 5-20 1882, cou.....	117 1/4	117 1/4
U. S. 5-20 1884, reg.....	117 1/4	117 1/4
U. S. 5-20 1884, cou.....	118 1/4	118 1/4
U. S. 5-20 1885, reg.....	118 1/4	118 1/4
U. S. 5-20 1885, cou.....	119 1/4	119 1/4
U. S. 5-20 1886, reg.....	119 1/4	119 1/4
U. S. 5-20 1886, cou.....	119 1/4	119 1/4
U. S. 5-20 1887, reg.....	119 1/4	119 1/4
U. S. 5-20 1887, cou.....	119 1/4	119 1/4
U. S. 5-20 1888, reg.....	119 1/4	119 1/4
U. S. 5-20 1888, cou.....	119 1/4	119 1/4
U. S. 10-40 1881, reg.....	114 1/4	114 1/4
U. S. 10-40 1881, cou.....	114 1/4	114 1/4
U. S. 10-40 1882, reg.....	114 1/4	114 1/4
U. S. 10-40 1882, cou.....	114 1/4	114 1/4

The following were the highest and lowest prices of stocks to-day:

	Highest.	Lowest.
N. Y. Cen. & Hudson Consolidated.....	102 1/2	102 1/2
Lake Shore.....	74 3/4	74 3/4
Rock Island.....	104 1/4	104 1/4
New Jersey Central.....	110 1/4	110 1/4
Del. & Lack. and Western.....	111 1/4	111 1/4
Wabash.....	14 1/4	14 1/4
Harlem.....	129 1/4	129 1/4
Western Union Telegraph.....	76 1/4	76 1/4
American District Telegraph.....	24 1/4	24 1/4
Northwestern.....	46 1/4	46 1/4
U. S. 6s 1881, reg.....	119 1/4	119 1/4
U. S. 6s 1881, cou.....	119 1/4	119 1/4
U. S. 6s 1882, reg.....	119 1/4	119 1/4
U. S. 6s 1882, cou.....	119 1/4	119 1/4
U. S. 6s 1883, reg.....	119 1/4	119 1/4
U. S. 6s 1883, cou.....	119 1/4	119 1/4
U. S. 6s 1884, reg.....	119 1/4	119 1/4
U. S. 6s 1884, cou.....	119 1/4	119 1/4
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U. S. 6s 1904, reg.....	119 1/4	119 1/4
U. S. 6s 1904, cou.....	119 1/4	119 1/4
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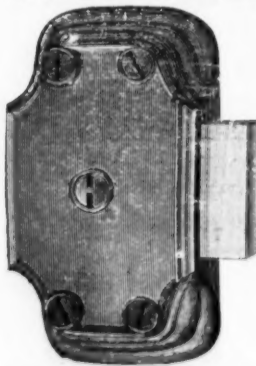
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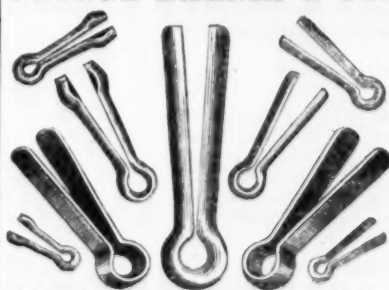
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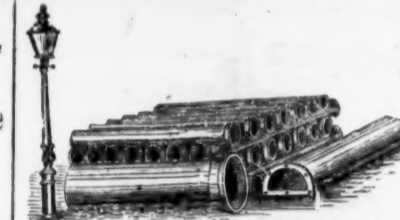
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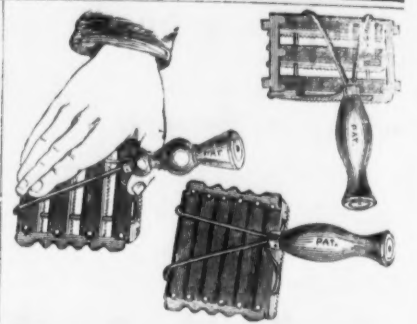
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more durable than any ever before invented. The raised
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viz: a rest and brace for the thumb, in such a position
that the hand cannot come in contact with the hair-
while using the comb. The wire braces which run from
the shank over the back to the front teeth give strength
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and at the same time serve as an extra handle; and
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shank the comb is more firmly, easily, and completely
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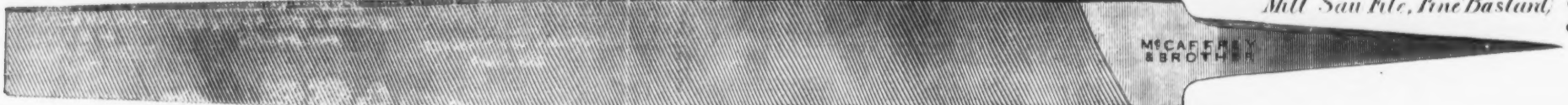
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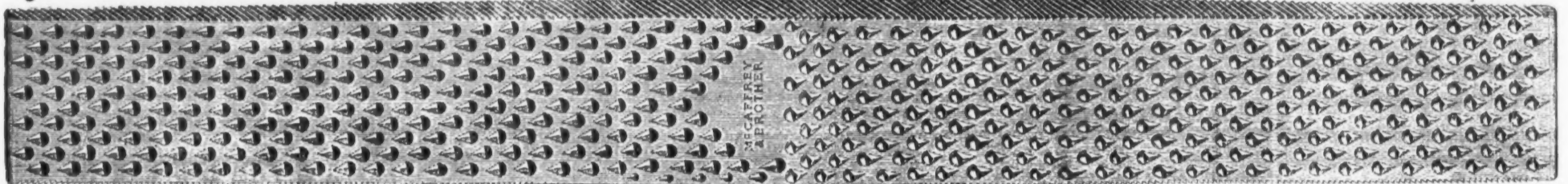


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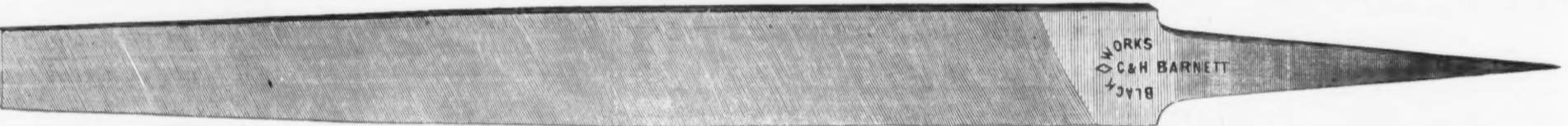


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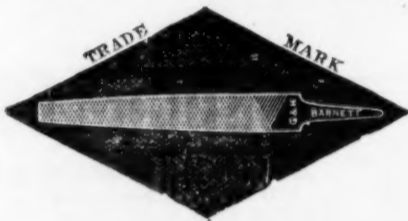
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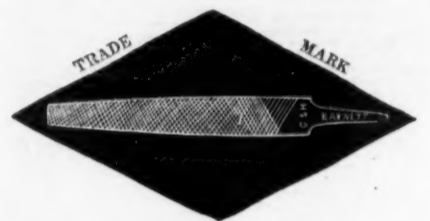
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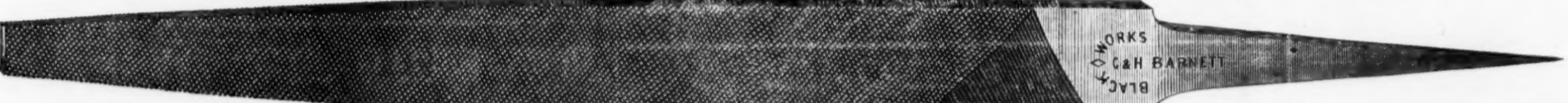
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(From an Occasional Correspondent.)

One of the most striking characteristics of the present century is the improvement which is constantly being made in the processes and implements employed in the industrial arts. The methods and appliances with which the artisans of the last generation accomplished the best results of their handicraft would be too simple or too clumsy for use in these utilitarian days, when whatever is done must be accomplished with a minimum expenditure of energy and in the least possible time; hence, the improvement in the tools and implements used in the arts has been rapid and general. And yet there are some forms and shapes of articles that have been used without material change from the earliest historic times, and are the same now, at least in appearance, as they were six thousand years ago. I was especially struck with this in the form of certain crucibles for melting steel which I lately saw at the crucible works of Messrs. Robert Taylor & Co., of Philadelphia. The prototypes of these same crucibles may be seen in any picture copied from ancient Egyptian sculpture showing the metallurgical operations of that country before the pyramids were built. The crucible seems to be one of the few things which has not been improved in form during all the centuries it has been in use, and the reason for this is found in the fact that the crucible was made as perfect in the first instance as it was possible to make it.

While speaking of matters historical, I may say that the origin of the name crucible is interesting. The alchemists, whose unsuccessful efforts to transmute base metals into gold furnished the basis for the science of chemistry, were very superstitious philosophers. To insure success in their labors, they used to mark with the sacred emblem of the cross the deep earthen vessels in which they melted their metals and compounded their alloys, and those vessels thus acquired a name from the Latin noun *crucis*, which it holds to this day. Looking into the modern history of crucibles, we find that if their shape has not been altered from the earliest times, one of the great improvements in modern metallurgy has resulted from their use. Without them cast steel would be an impossibility, as would be many of the most important operations in the arts in which the metals are employed.

The works of Messrs. Robert Taylor & Co., which I lately had an opportunity of examining, will well repay a visit even from those who have no practical interest in the subject. The processes followed in the manufacture of crucibles are interesting in themselves, and I think your readers will derive pleasure from having them described in your columns. The works are situated on the corner of Nineteenth and Callowhill streets, Philadelphia, and are very extensive—as indeed, they need to be, since all branches of the business must be carried on under one roof. The materials used are clay and plumbago, but it is of the utmost importance that they should be of the right kind, or the finished crucibles would not withstand the very great heat to which they are subjected when used. Mr. Taylor imports a German clay which he considers the best known material for the purpose. This is mixed with Ceylon plumbago, which is first ground, sifted and bolted. After the materials are mixed in the right proportions the mass is shoveled into a pug mill, where it is well worked, passing out at the bottom. The well mixed mass is kept in dark closets as long as they can do without using it, the longer the better for quality. It would, no doubt, be best of all, if we could imitate the Chinese in making porcelain, and lay up lumps of crucible mass in the cellar for the next generation to use, as it goes on improving all the time.

As in all branches of the potter's art, so in crucible making the first operation is forming the vessel on the throwing lathe. This most ancient of all pieces of machinery was originally a circular table top, revolving on the top of a fixed post, and it was turned with one hand; while the other modified the shape of the lump of soft and wet clay that was dumped on the middle of the top. The next change was the table top fastened to the shaft, and a corresponding wheel or disk on the shaft near the floor, the whole revolving, so that a workman sitting near the table could push the lower wheel around with his foot, and so use both hands to work in the clay mass. Crucibles are sometimes made by hand on such a throwing lathe as last described, the foot moving the wheel or a lever. It was a beautiful sight to see a man dash a huge lump of clay on the lathe, and proceed to work it up into a large crucible, capable of melting 300 lbs. or more

of brass in the few moments I was looking on. It seemed so easy to make one, that I felt disposed to try it, but upon mature reflection I concluded not to do it.

Crucibles for melting steel are smaller than those for brass and other metals which fuse at comparatively low temperatures. They hold only from 80 to 100 lbs. of metal, and are all made in molds of plaster of Paris, in a throwing machine called the jigger, and moved by the steam engine. The ball of moist clay mass, weighed out and worked by careful slapping, cutting and dashing into a suitable form, is thrown point foremost into the mold. The ball being in the mold, throwing wheel and mold are made to spin around with great velocity, when the workmen gradually lets down a former or profile of the inside of the crucible, made of a piece of strong iron and held by the machine, and which plunges into the whirling clay, until it spreads it evenly on the bottom and sides of the mold, giving the full shape and thickness of the crucible. The profile shapes the inside, the mold the outside, and the whole may be completed in a few minutes, so that one man can finish 10 to 20 in an hour. The freshly made crucible cannot be taken out of the mold at once or it would sink down by its own weight and softness into a lump of black dough; it is, therefore, taken to a frame, where there are hundreds of the same drying out a little before they can be opened and handled in the mold. This is the reason that it is necessary to have on hand hundreds of the massive plaster molds for crucibles of different sizes; and no trifling capital and space are locked up in plaster of Paris.

When the crucibles are taken out of the molds all irregularities in shape are carefully rectified, and they are then set aside in a warm space for air drying. Too rapid air drying, not drying enough, frost and sundry other dangers must be avoided, or the maker's reputation is in danger. The air dried crucibles are minutely examined for flaws and defects, and those that pass inspection are next put into sagger-circular bowls of burnt fire clay composition, with sides of about half the height of a crucible, and a little wider, so that a crucible being put into one, and another sagger inverted over it, the crucible is entirely covered from exposure to the direct flame of the furnace. Columns of these saggars, each pair containing a crucible,

closely pack the interior of the furnace from the floor to the roof, filling a space of 12 feet high by 12 feet diameter, and still larger.

Great care is required in gradually raising the heat in the dozen fire places around the outer base of the furnace, and maintaining it day and night until the crucibles are well burned. Too much or too long a heat would ruin the crucibles in the kiln, while too little would render them liable to break in the steel furnace and do worse damage.

The warerooms of Messrs. Taylor & Co.'s establishment present a curious appearance, filled as they are with columns of nested crucibles rising from floor to ceiling. At first glance all appeared alike to me, but a closer inspection revealed differences in shapes and sizes. The brass crucibles from No. 30 up to 300 had the usual puffed cheeks of crucibles, with a lip on the top to pour from. The steel pots, Nos. 40 and 50, had belled sides without lips, and were drawn closer together at the top. There was a host of smaller fry, dipping cups and skimming cups, stirrers, ladles, stools, &c., which, no doubt, are very useful in melting metals, but I cannot remember all their names and uses. Different trades, and even individual melters, seem to have their own peculiar favorite shape of cup or crucible, and there were cups and stirrers and melting pots of various shapes and sizes used at the U. S. Mint for melting gold and silver and cent metal. Mr. Taylor showed one pot in particular, in which more than \$100,000 worth of gold was melted at one time. I calculated how much that value of gold weighed, and found that it was over 5000 oz. Troy! I looked at him in doubt, and asked again, lest I had misunderstood. "Mr. Taylor do you say that they melt over 5000 oz. at once in one of those things made of clay and black lead? Why that is nearly the weight of two barrels of flour!" "Yes," said he, "and more than that, they melt that amount often without the pot showing the least sign of giving way." Here was a mystery, that soft clay and greasy black lead should hold the weight of over 350 pounds of gold in a perfectly fluid state, at a white heat, and not break down. "There is a good deal to learn," as King George said when he found out how the apple got into the dumpling.

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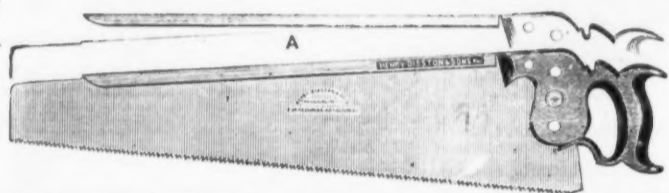
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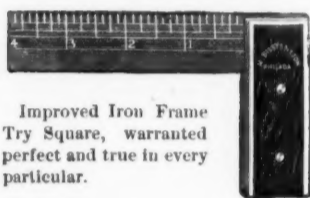
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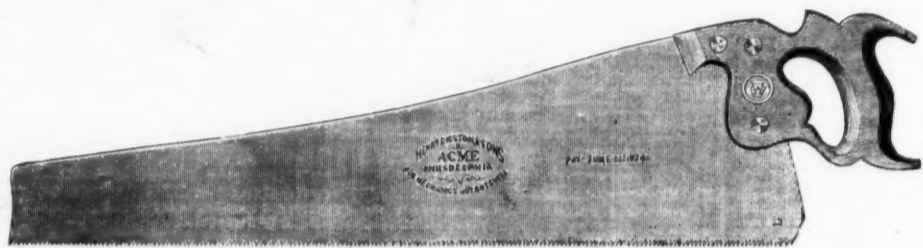
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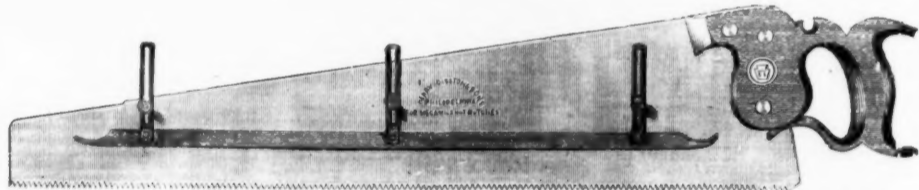
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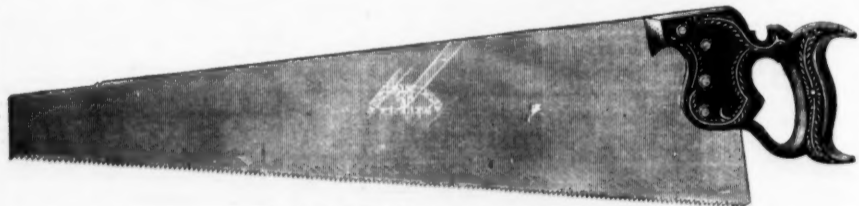
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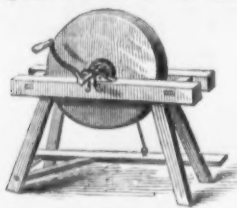
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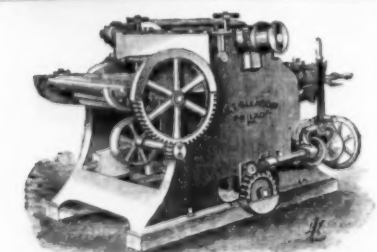
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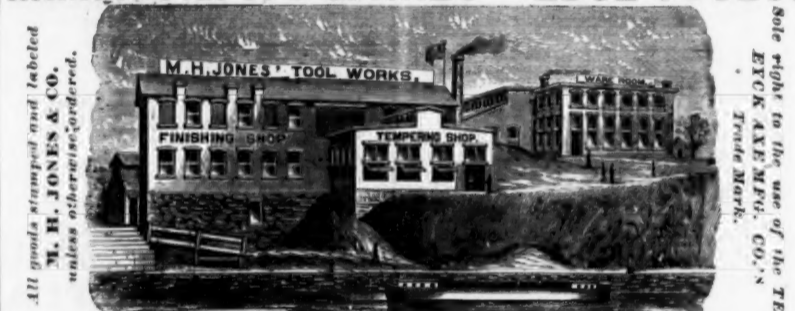
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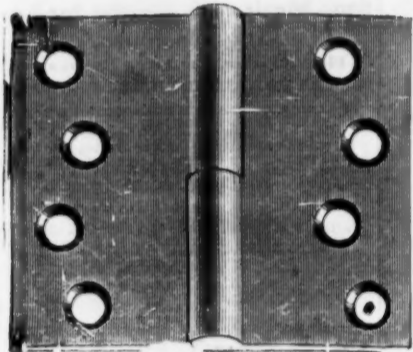
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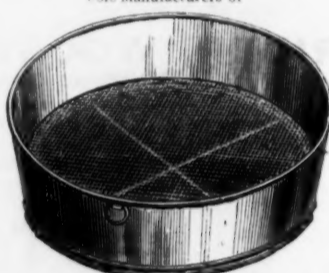
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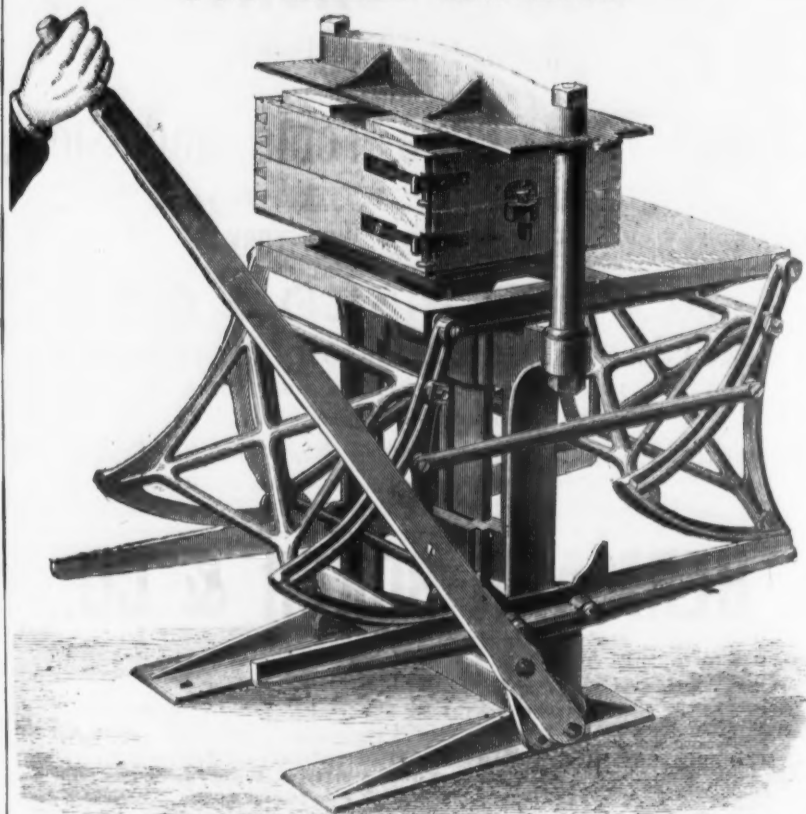
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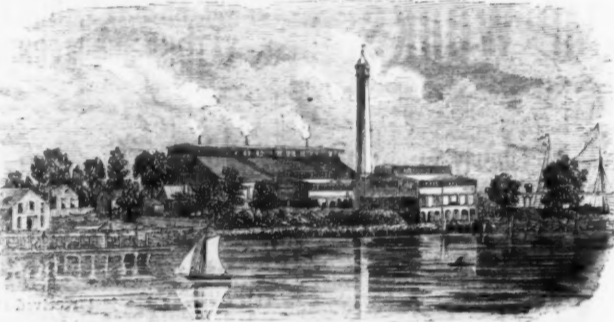
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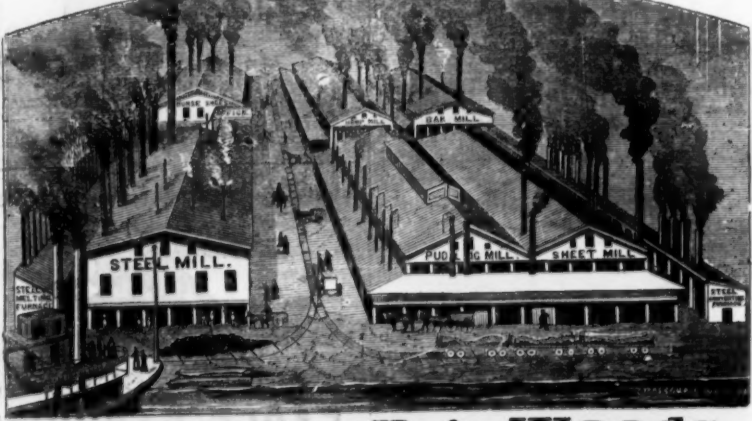
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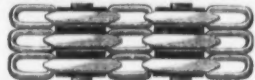
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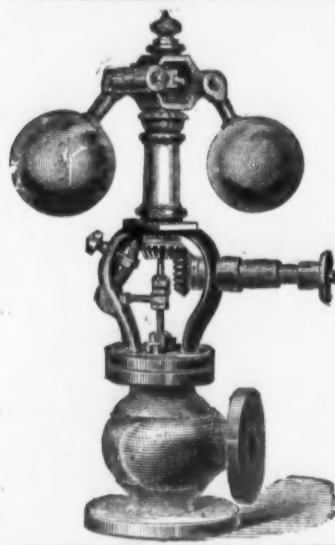
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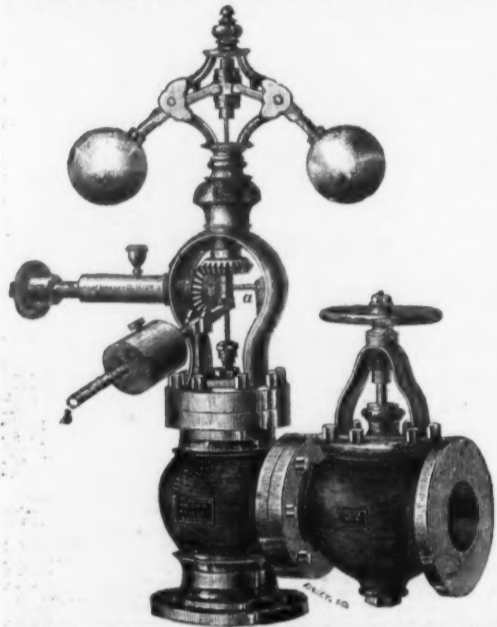
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2	20 00	22 00	19 00		
2 1/2	22 00	24 00	21 00	2 00	5 25
3	24 00	26 00	23 00	2 25	6 63
3 1/2	26 00	28 00	25 00	2 50	8 50
4	28 00	30 00	27 00	3 00	11 30
4 1/2	30 00	32 00	29 00	3 25	14 00
5	32 00	34 00	31 00	3 50	17 00
5 1/2	34 00	36 00	33 00	4 00	19 00
6	36 00	38 00	35 00	4 25	22 00
6 1/2	38 00	40 00	37 00	4 50	25 00
7	40 00	42 00	39 00	5 00	28 00
7 1/2	42 00	44 00	41 00	5 25	31 00
8	44 00	46 00	43 00	5 50	34 00
8 1/2	46 00	48 00	45 00	6 00	37 00
9	48 00	50 00	47 00	6 25	40 00
9 1/2	50 00	52 00	49 00	6 50	43 00
10	52 00	54 00	51 00	7 00	46 00
10 1/2	54 00	56 00	53 00	7 25	49 00
11	56 00	58 00	55 00	7 50	52 00
11 1/2	58 00	60 00	57 00	8 00	55 00
12	60 00	62 00	59 00	8 25	58 00
12 1/2	62 00	64 00	61 00	8 50	61 00
13	64 00	66 00	63 00	9 00	64 00
13 1/2	66 00	68 00	65 00	9 25	67 00
14	68 00	70 00	67 00	9 50	70 00
14 1/2	70 00	72 00	69 00	10 00	73 00
15	72 00	74 00	71 00		

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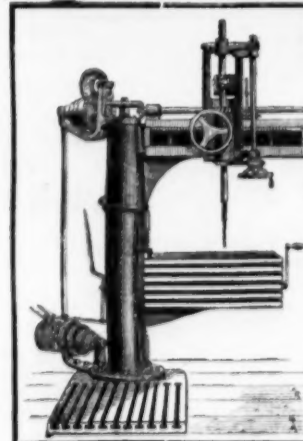
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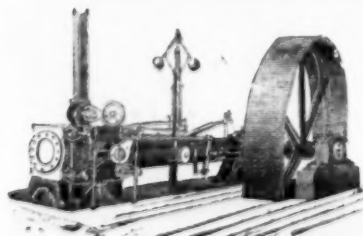
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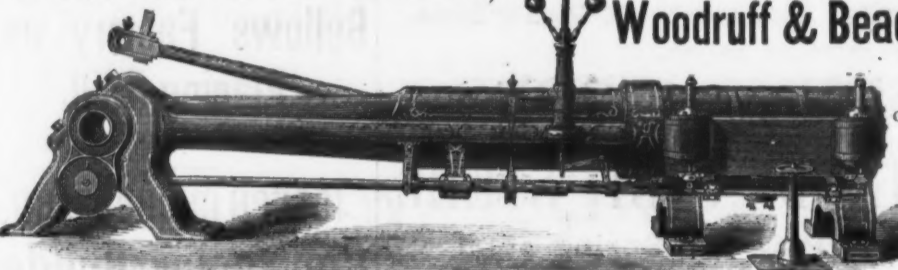
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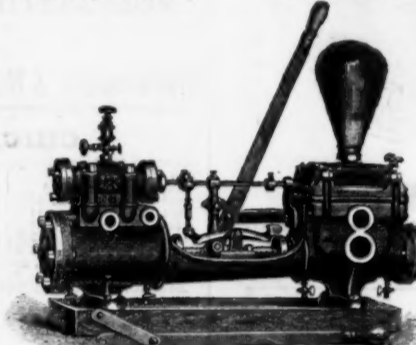
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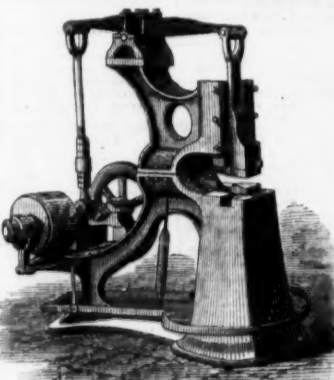
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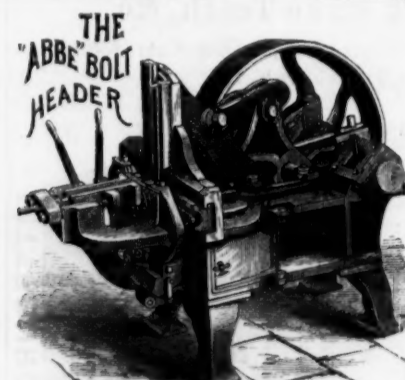
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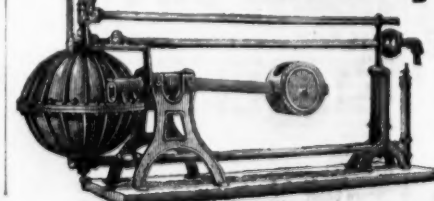
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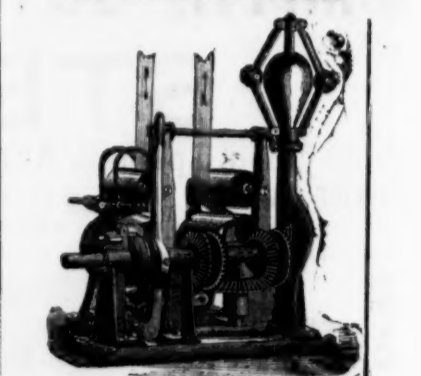
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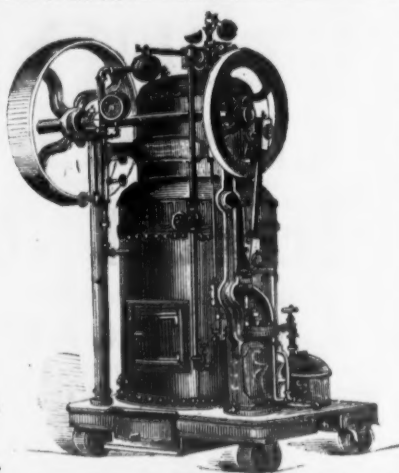
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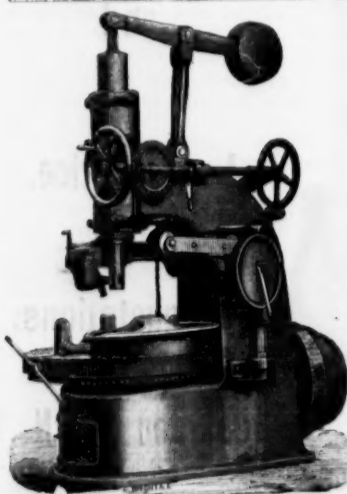
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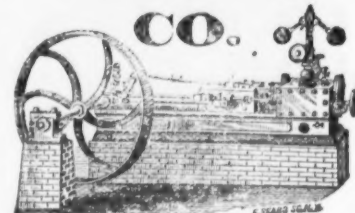
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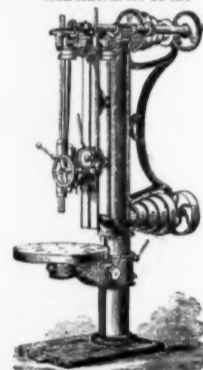
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